ELECTRICAL REVIEW

[ILLUSTRATED.]

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

Vol. 9. No. 22. WEEKLY. | NEW YORK, SATURDAY, JANUARY 29, 1887. | $3 per annum. Single Copies, 6 Cents.

Copyright, 1887, by ELECTRICAL REVIEW PUBLISHING COMPANY, 23 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

Novel Application of Electricity.

The covered street at Milan, now well known as the Victor Emanuel gallery, is roofed with glass and completed by a large dome, round the interior of which runs a chain of gas lamps. The lighting of these lamps at a considerable elevation used to present some difficulties, and was always a source of risk, until an arrangement was made for doing the work by electricity. A miniature railway has been constructed close to the gas burners, on which runs a little electric locomotive carrying a wick steeped in spirits of wine. When it is desired to light the burners the wick is set on fire and the locomotive started on its career. It flies round the dome, rapidly kindling the lights, and exciting much interest among the crowds that assemble nightly to witness the performance.

The Messenger Business.

Horace L. Hotchkiss, the Wall street broker, was the principal mover in the organization of the Stock Telegraph Company in 1867, and was its first secretary and treasurer. Ex-Governor A. B. Cornell backed him in that enterprise to the amount of $80,000 or $100,000, and fortunes were made out of it. It was in 1872 that Mr. Hotchkiss became secretary and treasurer of the American District Messenger Company, then just organized. I fell to talking with him about this enterprise the other day, says a correspondent, when some of the early ideas of the managers of that concern were mentioned. It was not thought possible that the messenger boys would ever be used extensively for other purposes than calling the police and giving the fire alarm. In discussing the field into which the service could be extended, a director of the company one day said: "Every business house in New York has its clerks and its errand boys and its porters and other persons, who can be used to go upon errands and take messages. They will never think of using our service for anything else than fires and police." Mr. Hotchkiss had different ideas, and gradually, after the boys were uniformed, the business of the company extended until, as every one knows, at the present time the police and fire calls are only a drop in the bucket, as compared with the general use of the messenger service.

The St Paul (Minn.) Gas Light Company is putting in the Weston long-distance system of incandescent lighting, and they are now running three 200-light machines, while the company anticipates covering the entire city with the system.

Automatic Telephone Switch Systems of Gould and Smith, Both Ground and Metallic Circuits.

In this automatic system each subscriber's line entering the exchange terminates in what may be properly termed a miniature central office. The terminal is movable, and each one is provided with every facility for ringing, speaking and connecting with every other subscriber or miniature central office on its own section (of 50, more or less), without the use of plugs and cords, and as every exchange endeavors to group together, as much as possible, the subscribers calling for each other, it is predicted that at least 60 per cent. of the connections made throughout the system can be done without the use of plugs or cords, and this too upon a rubbing contact.

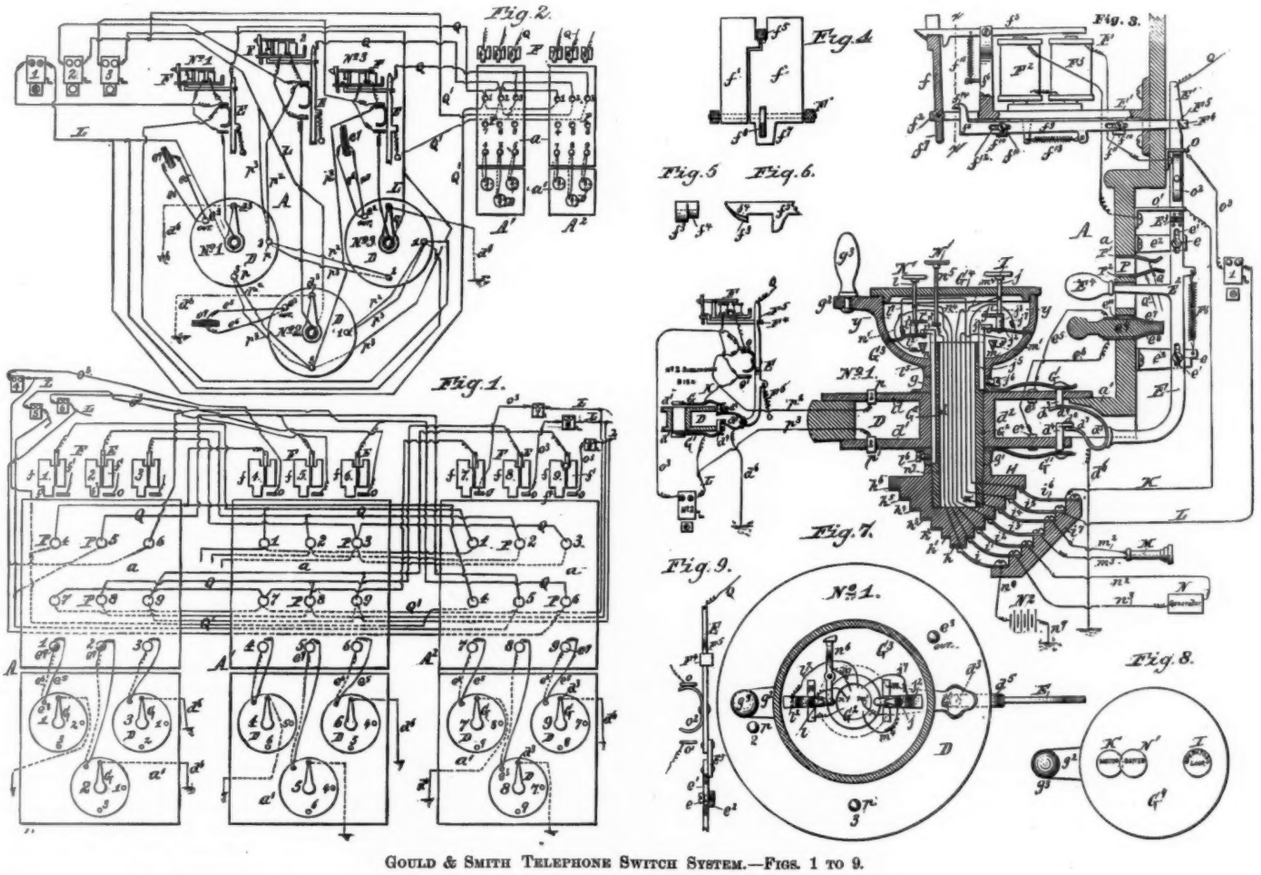
In this system, when the subscribers call the central office, they automatically open their own lines. It is clear that the instant the line opens, the subscriber's bell ceases to ring, proof positive to them that their call has been received at the central office, in full view of the operator, and that if any delay is experienced after that call has registered, the operator on that section is entirely and individually to blame for such delay.

Neither can the subscribers annoy the operator by continuous ringing after the call is once registered, if, for any reason, they are unable to speak to the subscriber on the instant.

If, on the other hand, the subscriber's bell (upon calling central office) continues to ring, it is conclusive evidence to the subscriber that his line or instrument are not in working order, upon which evidence the subscriber can report the fact at once, in the usual way, to the proper authorities, and at the same time attend to his own message without any further delay. Thus each subscriber tests his own line.

With the rapid growth of the telephone systems appears another element to interfere with good quick service, namely, the percentage of refusals or misconnections arising from various causes, no small percentage of which can be charged (more especially in small exchanges) to the lack of switch facilities (throughout the system) to reach the called subscriber at the instant wanted.

To obviate this now as well as to provide for the future, this system extends each subscriber's wire to every section throughout the system (from their respective annunciators), making it possible to connect together every subscriber (in the switch or system, small or



GOULD & SMITH TELEPHONE SWITCH SYSTEM.—FIGS. 1 TO 9.

large), or in other words, in a system of 5,000 wires, 2,500 of them could call for and be connected with the remaining 2,500. The expression, everybody's business is nobody's business, can be justly applied in this case to operating telephone switches, where the operators are more or less dependent upon each other for the connections from the first call to the disconnection. Here enters another disturbing element in the shape of cut-offs or disconnections before subscribers are through talking, and nobody to blame, or rather the greatest difficulty is experienced in locating the fault on the proper one.

This system expects to provide against such errors by making their occurrence impossible. Each operator's work is placed immediately in front of her. It is not necessary for one operator to speak to or assist another in operating the board. A large system of this kind can be worked (as far as manipulation is concerned) equally as well with each section in different rooms as if they were placed side by side in the same room. Disconnections can be made only by the operator that makes the connections; thus the entire responsibility for the connection rests with the operator receiving the subscriber's call, where it properly belongs. In this automatic system any foreign electrical interference with the line of sufficient strength to throw the annunciator apron instantly and automatically opens that line at the central office.

This diverts the current to the subscriber's instruments and ground, where protection is offered to those instruments by the automatic ground-switch (an attachment for call-bells, referred to elsewhere), which leaves the bell circuit open, and carries the foreign current through the lever to the ground direct, rendering it harmless to the instruments.

The combination of metallic and ground-circuit connections has not been lost sight of, in view of the future importance, together with the rapid advance already made in long-distance telephony.

This system offers facilities whereby metallic circuit subscribers can at their pleasure be connected with a neighboring city by metallic circuit, or with a ground circuit.

The manager's desk in this system is provided with a movable terminal and disk (the same as each subscriber), with telephone, galvanometer, and any other necessary points represented thereon, and his wire terminates on a section of the main switch in the same manner as any subscriber's, so that any wire in the system can be thrown to his desk terminal, and tested quickly and accurately.

The construction of this switch is so arranged that additional subscribers' disks can be added, one or more at a time, when necessary.

In the accompanying drawings, Fig. 1 is a diagram representing three sectional switchboards of a central office provided with this improved system. Fig. 2 is a diagram representing the manner of connecting the subscribers on one section, each with the other, and also how said subscribers are reached from either of the other sections. Fig. 3 represents a sectional elevation of one of the switch-levers, annunciators, and connecting parts on an enlarged scale. Fig. 4 is a sectional elevation in line x x, Fig. 3, looking forward. Fig. 5 is a front elevation of the vibrating lever. Fig. 6 is a side elevation of the front portion of the same on an enlarged scale. Fig. 7 is a horizontal section in line y y, Fig. 3. Fig. 8 is a top plan view of one of the levers. Fig. 9 is a fragmentary rear elevation of the switch-lever. Fig. 10 is a diagram representing a through connection between a metallic-circuit subscriber and a ground-circuit subscriber. Fig. 11 is a diagram representing a local connection between a metallic circuit subscriber and a ground-circuit subscriber.

Each disk D is provided with as many pairs of local contact points p p' as there are subscribers on the table, less one, and each of these contact points of one section is numbered to correspond with the number of the subscribers with which it is connected. For instance, the subscriber's disk D, No. 1, is provided with two pairs of local contact points p p', which are numbered 2 and 3. The subscriber's disk No. 2 has a similar number of contact points, which are numbered 1 and 3, and the subscriber's disk, No. 3, has its contact points p p' numbered 1 and 2. If No. 1 subscriber calls and thereby releases the apron f and switch-bar E, the operator raises the bar E by a handle E^4, so as to again complete the circuit by connecting the points d^3 and d^4 by the bow-string d^5. The bar E, when lifted by the operator, does not engage with the hook of the sliding bolt f^9, as the latter is held back out of engagement with the bar by the lip f^7 of the fallen apron f. He then loops in his listening telephone by pressing on the button I and ascertains that the subscriber wants, for instance, No. 2. The operator again allows the bar E to descend and break the connection between the fingers G G'. The operator now turns the fingers G G' on the subscriber's disk No. 1 to the contact points p p' marked No. 2. The upper contact point p (No. 2) on disk D, No. 1, is connected with the upper contact point o of No. 2 subscriber's annunciator F by means of a wire p^2, and the lower point p' (No. 2) disk No. 1, is connected with the return wire L of No. 2 subscriber's instrument by a leg or wire p, as clearly shown in Fig. 3. The operator now presses the generator button K' on No. 1 subscriber's disk, which causes the the armature f^5 of No. 2 subscriber's annunciator to vibrate and release its aprons f f and the switch-bar E in the same manner as in the case of No. 1 subscriber's first call, thereby automatically breaking the circuit between the points d^3 d^4 and fingers G G' on No. 2 subscriber's disk D. This movement rings both subscribers' bells simultaneously, notifying them that the connection between them is completed. No 1 is now connected with No. 2 by wire o^2, annunciator F, contact point o, line K, to and through finger G, as above described, to contact point p, disk D, No. 1, to upper contact point o, of No. 2 subscriber's annunciator by wire p^2, and to No. 2 instrument by wire o^2, returning through instrument No. 2 to wire L, to leg p^2, to contact p', No. 2, on No. 1 disk, to and through finger G', as above described, to No. 1 subscriber's instrument by line L. The operator now replaces the fallen aprons f f of both subscribers' annunciator F, leaving them ready to be rung off. By thus replacing the aprons f f the sliding bolt f^9 is released from the lip f^7 of the aprons f f, and is moved forward by the spring f^{12}, ready to engage with the switch-bar E. When the subscriber rings off, causing the aprons of No. 1 annunciator to again fall, the operator again replaces the same, and lifts the switch-bar E by the handle E^4 of both annunciators until they are again in engagement with the sliding bolt f^9. The operator also turns the fingers G G' on disk No 1 back to the points d^3 d^4, whereby both subscribers' lines are again ready for another call. By connecting the various subscribers on one section in this manner the use of cords and plugs are entirely dispensed with.

P represents a series of duplex contact points arranged in rows in the vertical portions a of each of the sections A A' A^2. The number of contact points P on each section corresponds with the number of subscribers on every other section or table. For example, section A has numbers 4, 5, 6, 7, 8 and 9, as this section can reach Nos. 1, 2 and 3 locally. Section A' has numbers 1, 2, 3, 7, 8, 9, and section A^2 has numbers 1, 2, 3, 4, 5, 6, their own local numbers not being represented in the contact points P. The contact points P are provided at their upper and lower ends wirh separate metallic contact surfaces or springs P' P^2. The springs P' P^2 are adapted to form contacts with the metallic contact points e^7 e^8, respectively, of the plug e^9, also to securely hold the plug e^9 when the latter is inserted in the contact point P. Each annunciator is connected with all of the contact points P of the several sections bearing the same number as of the annunciator by a wire Q, or other metallic connection, which is secured with one end to the upper conductive portion of the switch-bar E and connected with the upper contact surfaces, P', of the several contact points P.

Q' represents a similar wire or metallic connection, which connects the lower contact surfaces P^2, of the contact points P in the same manner, and which is connected to the main or return wire L of the subscriber's instrument corresponding with the annunciator with which the wire Q is connected. For instance, the wire Q is connected with the upper contact surfaces, P', of the contact points No. 7 and with the switch lever E of annunciator No. 7, and the wire Q' is connected with the lower contact surfaces P^2, of the contact points No. 7 and with the wire or line L of subscriber's instrument No. 7. Thus it will be seen that the various subscribers in a central office are practically grouped within reach of each operator on each of the sections A A' A^2.

The operation of this improved system for connecting the subscribers on one table or section with a subscriber located on any other section or table is as follows: For instance,

Fig. 10.

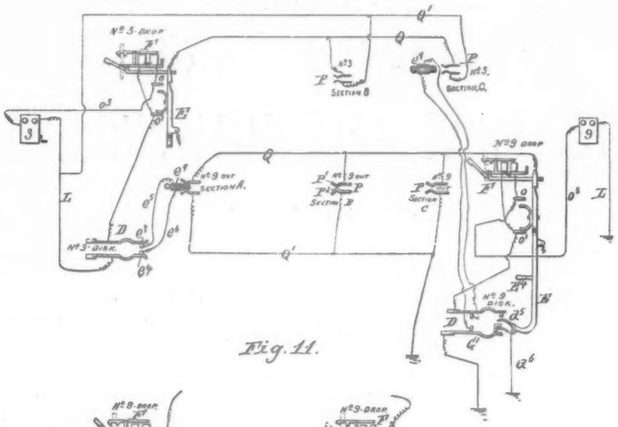
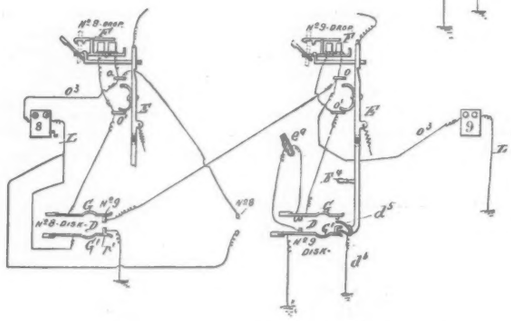
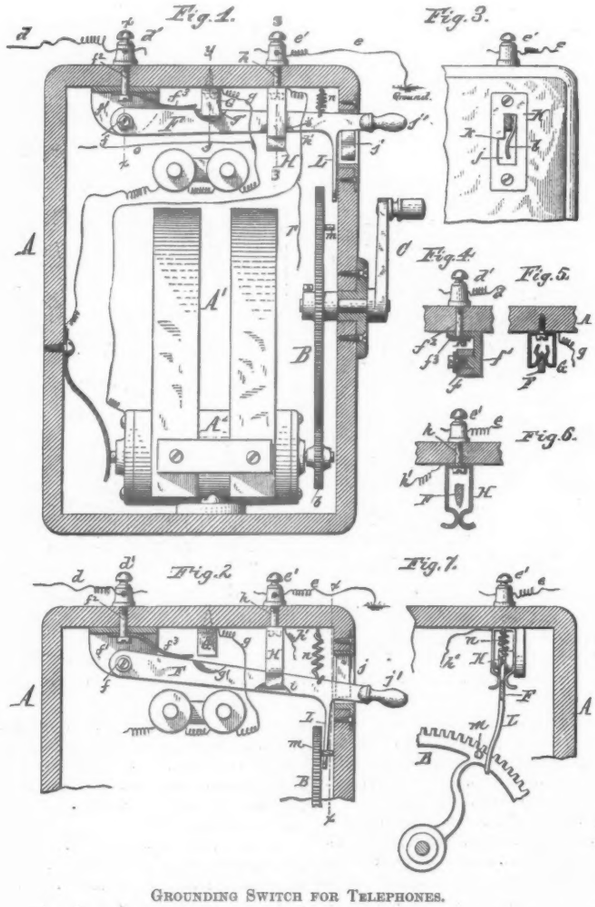


Fig. 11.



FIGS. 10 AND 11 OF GOULD & SMITH SYSTEM.



GROUNDING SWITCH FOR TELEPHONES.

subscriber No. 1 calls the central office through the line o^3, annunciator F, line K, fingers G G', and line L, as above described. The operator raises the switch-bar E, presses the button I, loops in the listening telephone M, and ascertains that subscriber No. 1 wants, say, No. 9. The operator again allows the switch-bar E to drop and break the connection between the two fingers G G'. He then turns the fingers G G' by means of the handle g^3 to the dead contact points e^6 e^4 of the disk D, and inserts the plug e^9 of disk No 1 in contact point P No. 9 of the section A. The connection is now made with the contact surfaces P' P^2 by the metallic contact surfaces e^7 e^8 of the plug e^9, and with the fingers G G' by the wires or cords e^5 e^6 and contact points e^3 e^4. By thus inserting the plug e^9 the wires Q and Q' are connected with the fingers G G' respectively. The operator now presses the battery button N' on disk D, No. 1, which causes just sufficient vibration of the armature to release the apron f' of annunciator No. 9, thereby notifying the operator on whose table annunciator No. 9 is located that an operator on some other section is about to connect with No. 9. The operator of section A now releases the battery button N', and presses the generator button K' on disk D No. 1, thus ringing through wire Q, finger G, to the upper contact P, plug contact e^7, to switch-bar E of subscriber's annunciator No. 9, to the upper contact point o of the same, to and through annunciator No. 9, to contact o', to fingers G G', disk No. 9, returning by wire Q' to finger G' on disk D No. 1. This movement causes the apron f of subscriber's annunciator No. 9 to fall also and disengage the switch-bar E, thereby disconnecting the fingers G G' on disk D No. 9, as in the case of No. 1 subscriber's first call. This movement also rings the bells on the instruments of both subscribers, notifying them that the connection between them is completed. Subscriber No. 1 is now connected with subscriber No. 9 to and through the finger G, as above described, wire e^5, contact e^7, upper contact surface p', of point No. 9 on section A, wire Q, to switch-bar E, and lower contract o', of annunciator No. 9, to and through said annunciator, to the upper contact o of said annunciator, to the instrument of subscriber No. 9, returning from said instrument through line L to the lower wire Q', to the lower contact surface p^2, of point No. 9 on section A, to the lower plug contact e^3, to wire e^6, to lower finger G', to line L of the instrument of subscriber No. 1, thus completing the metallic circuit. The operators now replace the fallen aprons f f' on annunciators 1 and 9, ready to be rung off.

Fig. 10 is a diagram showing a subscriber's line No. 3 having a metallic circuit connected with subscriber's line No. 9 having a ground circuit. Such a connection may become necessary when the same central office has subscribers with these different circuits, or when a subscriber in one place having one of these circuits is connected with a subscriber in another place having a different circuit. As shown in Fig. 10, the lower finger G' of the ground circuit subscriber No. 9 is grounded. The metallic circuit of subscriber No. 3 is also grounded by a ground connection made by the lower wire Q' as shown.

Fig. 11 is a diagram showing local connection between a subscriber's line No. 8 having a metallic circuit and a subcriber's line No. 9 having a ground circuit. In this case the lower contact point p' No. 9 is grounded on disk D No. 8 and on any other disk on the same take on which it may appear.

The bow d^5 constitutes the automatically-movable contact piece which is interposed in the central office between the two terminal points of the metallic circuit, and which completes the circuit through which the subscriber reaches the central office. This movable contact piece, upon being automatically moved out of its normal position, leaves the line open and ready to be connected with the terminal points of another metallic circuit. The operator, by calling the line which is to be connected with the calling line, connects with and automatically opens the called line in one motion. When the contact piece d^5 is in its normal position, it connects the movable terminal fingers G G' of the line by means of the contact points d^3 d^4, and when the line has been opened by moving the connecting bow d^5 out of its normal position, the line is ready to be connected by the fingers G G' with the terminals of another metallic circuit.

GOULD'S GROUNDING SWITCH FOR TELEPHONE INSTRUMENTS.

This relates to lightning arresters or grounding switches for telephones, and has the object to break the connection with the instrument completely when protection against lightning is desired, and to restore the connection automatically when the instrument is required for use.

In the accompanying drawings, Fig. 1 is a sectional elevation of the call-bell mechanism of a telephone instrument, showing the main line in connection with the instrument. Fig. 2 is a similar elevation of the upper portion of the instrument, showing the main line disconnected from the instrument and connected directly with the ground. Fig. 3 is a fragmentary end elevation of the upper portion of the instrument. Figs. 4, 5 and 6 are vertical cross sections in lines x x, y y and z z, Fig. 1, respectively. Fig. 7 is a cross section in line x x, Fig. 2.

When the lever F is in its upper and normal position, as represented in Figs. 1, 3 and 5, the current passes through the main line d, post d', bolt f^3, lever F, contact spring G and wire g to the instrument, which latter is connected with the ground post e' by the wire h', while the lever F is disconnected from the ground contact spring H. When it is desired to protect the instrument against electrical disturbances, the lever F is depressed until it is locked against the stop k, whereby the lever is disconnected from the instrument contact point G, and connected with the ground contact point H, as represented in Fig. 2. In this position of the lever an electrical current entering the lever from the main line cannot reach the instrument, but is conducted by the lever directly to the ground point, thus rendering it impossible for any part of the current to reach and injure the instrument.

L represents an arm formed on or secured to the lever F in the case A and depending toward the gear-wheel B.

m represents one or more pins secured to the side of the gear-wheel B in the proper position to strike against the arm L when the lever F is depressed and move the lever laterally on its pivot in the proper direction to disengage it from the stop k, as represented in Fig. 2, but to clear the arm L when the lever is in its upper position, as represented in Fig. 1.

n represents a spring whereby the lever is connected to the top of the case A, and which raises the lever when it is released from the stop k.

When the lever has been depressed for protecting the instrument and is left in this position, it is automatically released by the pin m striking against the arm L upon turning the crank of the call-bell. In this manner the connection with the main line is automatically established upon operating the call mechanism, and the annoyances resulting from neglected lightning arresters are avoided.

Upon depressing the lever F, and breaking the connection between the bell mechanism and the main line it is easy to discover short circuits in the bell mechanism, if such should exist.

GOULD'S ADJUSTABLE SUPPORT FOR TELEPHONES.

This invention relates to an adjustable telephone support, which can be raised and lowered to adjust the position of the telephone as may be most convenient for the person using it. It is frequently the case that the same telephone is used by persons of greatly different height, in which case the telephone is inconvenient for very tall and very small persons when adjusted for the average height.

The object of this invention is to render the telephone adjustable in such manner that it can be quickly raised and lowered by the person using it.

In the accompanying drawings, Fig. 1 is a sectional side elevation of the improved telephone support. Fig. 2 is a horizontal section in line x x, Fig. 1, on an enlarged scale.

By properly adjusting the tension of the springs h sufficient friction can be created between the bearing surfaces of the arms D D' and the rod C to support the telephone frame in any desired position on the rod, and at the same time afford sufficient freedom of movement to permit the telephone frame to be quickly and easily raised and lowered on the rod, when desired. By this means the person using the telephone is enabled to adjust the same readily to the most convenient position

Fig. 1.

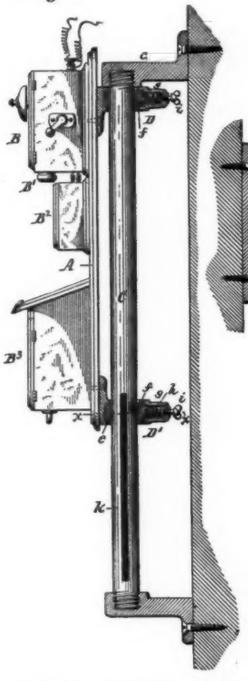
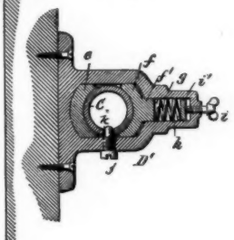


Fig. 2.



GOULD'S ADJUSTABLE SUPPORT FOR TELEPHONES.

Electric Sparklets.

It was in the l afy month of October, at a banquet in honor of the installation of an electric light plant. After suitable electrification, the speech-making began. When it came to Alderman Muldoon's turn, he rose and said: "Mistther Chairman! The gintlemen here this avening have told us much about 'lectricity; but for my own part, Mr. Chairrurman, I haven't yit heard what sets that hair-pin on fire."

The story is told of a philosopher from the rural district, who registered at a hotel lighted by an incandescent system, and on retiring tried to remove the globe from the incandescent lamp to blow out the light.

Into the factory of the Moon Electric Light Company there came to work one of those young men who know so much they can't be told anything. The first day he tried to take off the glass globe of an incandescent lamp to straighten the filament.

A Boston gentleman had an elaborate installation of gas lighting apparatus. For a time all worked well. Then the battery ran down—zincs eaten, or solution exhausted, or porous cups to be renewed—all the time. He was beaten at every point. There were no grounds on the battery wire. One evening, while attending a lecture where the danger of short circuits from damp walls or ceilings was discussed, he remembered the damp condition of the cellar in which his battery was placed. Returning home he found that the spiders had connected the battery wire with the gas pipe, by their webs, and the condensation of moisture upon them formed a path for the current. The next day there was incorporated in the rules of the Board of underwriters, "that cobwebs should be dusted from wires at least once a day."

The electric lights are gaining rapidly in public favor in Providence, R. I., and from every section of the city petitions are being sent in to the City Council, asking that the circuits may be extended or new ones built. There are seven circuits in use by the city, with an aggregate of 175 lamps. Since the city decided to equalize the patronage of the two local companies and voted to pay living rates a competition has sprung up between them, the object of which is to furnish superior lights and the city is reaping a substantial benefit from it. The improved lights and the effectiveness of the service have awakened an interest among people, even who heretofore were opposed to the electric system and as a result a large number of petitions for additional lamps have been laid before the City Council for action.

The New Rochester Telephone Co.

The plan deemed most feasible for starting operations was to put in several machines in the center of the city, and let the people get acquainted with them Then enlarge the plant as the business of the company required.

The following officers were elected: President, J. W. Goss; vice-presidents, George H. Newell, Jonas Jones, James W. Gillis; secretary, F. J. Amsden; treasurer, H. F. Huntington.

J. W. Goss, J. W. Gillis, E. A. Chase, F. R. Winne, G. H. Newell and H. F. Huntington, and, by special vote, Nathaniel Foote, were elected to confer with the agents of the Writing Telegraph Company. If possible, the gentlemen are to close negotiations with the company. A report of the treasurer showed the total amount of money paid in to be $534.55, and the amount on hand is $236.55. It was then moved that pamphlets be printed, showing what amendments were needed in the city charter, and that these pamphlets should be given to a member of the Legislature at Albany from Rochester, asking him to circulate them among the members of the Legislature. The president was then directed to call a meeting of the subscribers by postal card when he deemed proper.

ELECTRICAL REVIEW

Published at 23 Park Row.
P. O. BOX 3329.

GEO. WORTHINGTON, - - - Editor
CHARLES W. PRICE, Associate "
LOREN N. DOWNS, President.
ANDREW J. DAM, - Vice-Pres't and Treas.
C. C. HASKINS,)
GEO. A. HAMILTON, - Consulting Electricians.
GEO. H. BENJAMIN.)

SUBSCRIPTION
United States and Canada, $3.00 per annum, in advance. Postage paid by publisher.
Great Britain and other foreign countries, $4.00, in advance. Postage paid by publisher.

ADVERTISING.
Transient, 25 cents per line, nonpareil.

EDITORIAL ANNOUNCEMENT.
Address all communications and make all Express Money orders, P. O. orders and checks, payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

Frank M. Gilley, 54 Equitable Building, Boston, Mass., is our New England representative.
Mr. C. C. Haskins, 118 LaSalle Street, Chicago, Ill, will represent the REVIEW in the West.
Messrs. Wm. Dawson & Sons, 121 Cannon Street, London, England, are our representatives for Great Britain.

NEW YORK, JANUARY 29, 1887.

CONTENTS.

	PAGE
Novel Application of Electricity	1
The Messenger Business	1
Automatic Telephone Switch Systems of Gould and Smith, both Ground and Metallic Systems	1, 2, 3
Electric Sparklets	3
The New Rochester Telephone Company	3
Editorial Notes	4
The Colossal Dynamo a Commercial Success	4
More Telephone Controversy	4
The Meucci Telephone Case Again	4
Heating Railway Cars	4
Chicago Electrical News	5
Boston Electrical News	5
Telephonic News	6
An Important Decision in Canada	6
The Rochester Telephone Situation	6
Hunting Telephone Information	6
Special Report Made to the Board of Brooklyn Subway Commissioners by Professor Plympton, its President, as to Telephone and Telegraph Systems in European Cities	6, 7
Telegraphic	7
Electrical and Scientific	8
Putting the Wires into the New York Conduits	8
A Little Joke About the First Atlantic Cable	8
Digest of U. S. Patents on Storage Batteries	8
The Telephone Caught the Lost Boy	8
Construction of Electric Light Stations	9
The Electric Headlights	9
Electric Light and Gas Companies	9
Electric Light News	9
Electrical Patents	10

The National Electric Light Association convenes in Philadelphia at the Hotel Lafayette, February 15th. The attendance promises to be unusually large and representative.

A telephone bill is before the Ohio Legislature, introduced by Representative Strecker, of Washington County, which is similar in the main to the law passed by the Indiana Legislature a year ago. Thus do all things equalize. The Indiana legislature, with a realizing sense of the fact that the last legislature made a mistake, is endeavoring to repeal the law, and the Ohio legislature with hindsights of rare and unique strength, is endeavoring to pass it.

The Legal Committee of the National Electric Light Association, of which Mr. Arthur Steuart is the able general counsel, has decided to present to the Association at the Philadelphia meeting some very important measures for the reform of the patent system. These changes have been carefully considered with the U. S. Commissioner of Patents, Hon. M. V. Montgomery, who will be present at Philadelphia, and address the convention in favor of these measures. This will be a valuable feature of the convention, and all who desire to see an improvement in our present patent system should come prepared to aid in the intelligent consideration of the valuable suggestions that will be made by the Legal Committee.

The next meeting of The Electric Club promises to be particularly interesting. In addition to the pleasant social features of the meeting, Mr. Henry Hine, of the United States Electric Lighting Company, will read a paper on "Electricity and Insurance," and a number of leading insurance men will be present to participate in the discussion. It is hoped that from this will come uniform and comprehensive rules that can be universally adopted, and which will be satisfactory to the electrical and insurance interests alike.

A delegation of the city officials of Cleveland, O., consisting of Mayor George W. Gardner, C. G. Fore, city engineer; H. H. Rebbeck, city electrician; David Monson, building inspector, and Aldermen Hermann, Seigris and Carpenter, were New York visitors this week. They were here to examine the electric subway system, with a view of adopting it in Cleveland. They are reported to have been well pleased with what they saw on Sixth avenue, where the Dorsett conduit was being filled with the wires of the telephone company.

Mr. Thomas A. Edison, it gives us much pleasure to state, is very much better and apparently on the road to permanent improvement in health. His illness—pleurisy—has been quite severe, and through it he has been carefully tended by his devoted wife. His most intimate friend, Mr. E. T. Gilliland, has been constant in his attention, and it is to his thoughtfulness in promptly securing the services of two eminent New York physicians Mr. Edison's early recovery is no doubt due. These two distinguished electricians and their families expect to start for Florida in a couple of weeks.

The Electric Subway Commissioners, of this city, are not to have smooth sailing it seems. Judge Van Hoesen, in the Court of Common Pleas, on Monday last, denied the application to restrain the New York Underground Telegraph Company from placing conduits underground. He refers to the monopoly now held by the Consolidated Telegraph and Electrical Construction Company over the subway system, and says that the assumption by the Commissioners of the power to grant to this company the right to build subways in the streets of this city is without warrant of law, and that only the Legislature can grant the use of the streets in a city, and that without express permission from the Legislature no public officer has any more authority than the humblest private citizen to convey any right or privilege whatsoever in any highway.

On Monday last the argument in the telephone suit to test the Bell patent began in the United States Supreme Court. Seven judges only will sit in this case, so there will be no danger of a tie. All the eminent counsel for and against the Bell interests are present. It is the expectation of the parties in interest, as well as the desire of the court, that the contest over the substantial principles of the telephone shall be settled in this suit. There has not been for years such a formidable preparation for a hearing, nor has there been a suit in which such vast interests were involved. The printing of the record in the appeal in one of the cases alone cost $1,000. The brief and the various documents relating to the suit in all its various phases would fill a good-sized library. The briefs of the Bell Company are bound at their own expense in handsome turkey morocco. The court has granted forty hours, or ten days, for the hearing. Messrs. Bell and Gray are both present.

The great number of underground wires in England have often been commented on by our anti-aerial citizens who claimed this to be convincing proof of the ease with which wires could be buried and yet work satisfactorily. The following from London *Truth* of recent date, would indicate that America is in the lead in this matter: "We have been made a by-word among nations by the break-down of our telegraph and telephone system under the snow storm of last week. Perhaps that need not trouble us very much, but the practical inconvenience to ourselves is a matter that ought to be attended to. The actual money loss caused by a complete suspension of telegraphic communications for three or four days would go far to pay for the introduction of an underground system; and this is a trifle compared with the dangers created in London by falling wires and by broken wires being recklessly coiled around lamp-posts, or anything else that comes handy. In the principal American cities overhead wires have been gradually done away with during the last two or three years, and our Post Office ought to recognize that the time has now come when it must do likewise."

THE COLOSSAL DYNAMO A COMMERCIAL SUCCESS.

In electrical enterprise, as in many other branches of indusrial progress, America still leads Europe, and this fact is fully exemplified in the success attending the operation of the colossal Brush dynamo machine, description of which was given in this journal a few months ago. This dynamo, which has the largest electrical output of any in the world, was set to work by its purchasers, the Cowles Electric Smelting and Aluminum Company, at Lockport, N. Y., immediately on its completion, and has been running regularly twenty hours per day ever since, no accident or stoppage of any kind having occurred in this period of over six months. This is indeed a very remarkable performance for a dynamo of such mammoth proportions, as we are under the impression that all large dynamos which have been built abroad have been practical failures. The big Brush dynamo has enabled the Cowles company to produce their metal in commercial quantities. Their business has been gradually enlarging, and they are receiving very extensive orders, both domestic and foreign for their product. The demand having exceeded the capacity of their works, the Cowles company have given an order for two more of the colossal dynamos, which the Brush Electric Company have agreed to furnish within three months.

MORE TELEPHONE CONTROVERSY.

The telephone controversy goes on apace, and whilst the so-called "revelations" constantly appearing, are rarely new and not always good, and, indeed, at times neither new nor good, nevertheless the general discussion is interesting and valuable. It is not our purpose to give an opinion upon the soundness of the claims put forward by Bell, though it is likely before we get through we shall put before the reader some rather puzzling testimony, leaving him to form his own opinion.

The long story telegraphed last week from Chicago to the New York *World* as to Antonio Meucci's claim to the invention of the telephone, is interesting, very interesting, but unfortunately it is not new. The Chicago *Evening News* did not discover Meucci or his little story, though we believe it to be entirely honest in its belief that it did. We would inform our sprightly and readable Chicago contemporary that Meucci is an old friend of ours who has lived on Staten Island, in the Bay, for many a long year. He was a warm personal friend of Garibaldi, who lived with him on Staten Island for several years, and since the Italian patriot left these shores the noble old fellow Meucci has been engaged in dreaming of his absent friend retelling the story of his discovery of telephonic action and attending a little flower garden in the rear of his house. Unlike other aged people whose stories grow longer and more tiresome as the years go by, Meucci's little story becomes more and more interesting. Every twelfth month it seems to contain still more positive proof of the justness of the old gentleman's claims, and so comprehensive and elastic has it now become that, if Meucci lives five years longer, his little claim will make him the inventor of the telegraph as well as the telephone; and, perhaps, of several other things. We do not mean by this to deny that Meucci talked through a paper cone in Cuba in 1851, and that in this experiment he used a membraneous diaphragm like those used in later years by Bell. Indeed we don't say that the old gentleman didn't invent the telephone, because we don't know whether he did or not. We only want to put in a mild protest against Meucci's being foisted upon the public as "a new claimant for the telephone."

THE MEUCCI TELEPHONE CASE AGAIN.

The case of Antonio Meucci, the Italian, who claims to have filed in 1871 a caveat for a "sound telegraph" outlining the principles of the telephone, bobs up serenely again, this time in Chicago, and several of our usually wide-awake New York dailies published the "news" in conspicuous columns with striking head lines. This is very amusing. Meucci was present during the celebrated hearing in behalf of the Pan-Electric Company before Secretary Lamar, and his claims as a prior inventor were presented, but made no impression. In all the telephone litigation of the last ten years the Meucci claims have figured. In the decision of the United States Circuit Court at New Orleans last year, reaffirming the validity of the Bell patent, Judges Pardee and Billings said: "The Meucci defence that is brought forward in defendant's record on the motion, taking up 120 printed pages, was abandoned by counsel on the hearing, and no effort made to sustain it." The notes given by Meucci as having been made at the time of the filing of his caveat were, if we are not mistaken, found to have been made in a note-book manufactured by a firm that was not in existence until several years later.

Our bright and esteemed contemporary, the New York *Sun*, is seldom caught napping, but last Saturday morning it presented the Meucci matter as a prominent and startling Chicago dispatch. The next day the mistake was realized, and the *Sun* said:

"The boss lying of the age is in the telephone lawsuits. We published yesterday a full specimen. The so-called Government case has its abundant share of these interesting eccentricities."

HEATING RAILWAY CARS.

In view of the recent railway accidents, and the loss of many valuable lives and large amounts of property by fire, the question naturally arises: Cannot some means be devised by which the present system of heating cars by means of coal-burning stoves can be done away with?

Very many devices have been suggested, as, for instance, heating by steam derived from the engine boiler, or from an independent boiler carried in the baggage car. Chemical boilers, by which heat is generated by the decomposition of a substance, or substances, such as caustic potash and soda; and electric stoves in which the heat is derived from a current from primary batteries.

Of the first we have the objection raised that the engine boiler in use is not sufficient in capacity, and that it is not expedient to increase its size, for mechanical reasons. As to the second—*i. e.*, independent boiler—we have the objections: First, the dead load required to be moved, and, secondly, the fact that the laws of many of the States require that the heating apparatus of each car shall be self-contained. In the olden days of railroading the coupling link had a disagreeable way of breaking, and a car would thus be left by the rest of the train, and the passengers be in imminent danger of perishing by cold before the loss was discovered. Again, some accident would require the engine to leave the train, and go in search of assistance. At the present day such conditions are not apt to occur; but so long as such laws remain in force, they must be considered by the management of railway companies.

Chemical and electrical devices have been practically prohibited by reason of their cost of maintenance. It seems to us that as the storage battery now bids fair to become practically successful, and capable of furnishing a considerable current at low cost, that some of our ingenious electrical friends ought to be able to devise an efficient apparatus for the purpose.

By way of suggestion to those having an inventive turn of mind we would say, why not make a device that would utilize both the electrical and chemical agencies of producing heat? Say a boiler containing a solution of a salt of alum, which when heated very slowly parts with its heat. The heat would be primarily imparted by a current of electricity—and, secondly, in case the stored current of electricity should give out, by the action of caustic soda, as in the Honigmann boiler. The required chemical could be readily carried, and the batteries could be kept charged by means of a dynamo actuated by the moving power of the train.

We think there is something in this suggestion, and we hope that some active brain will evolve an apparatus which will prove a positive boon to humanity, and at the same time add to the accumulation of wealth of its happy possesser.

CHICAGO ELECTRICAL NEWS.

The signal office promised a blizzard for the 17th. It is needless to remark that this draft on the credulity of the average citizen was duly honored, for the whole thing was in excess of our most sanguine expectations. A concise condensation from the many accounts would read something like this :

Michigan.—Three Rivers—worst storm of the season—trains all behind—snow—wind, great guns. St. Joseph—blizzard—worse every minute. Grand Haven—worst of the season—gale all day—steamers Wisconsin and Roanoke safe in port. Cheboygan—snow, big heaps, everywhere—business suspended—trains blocked or behind all round. Coldwater—blizzard all day—weather all drifts, and no business.

Indiana.—Lafayette—trains on the L. N. A. & C. R. R. [Long, Narrow, Awkward and Crooked ?] road stuck in drift near St. Johns—troupe billed for to-night here on board—two trains in drift (which is — miles in length) this side of the first—wind fills the cuts as fast as they dig out. Elkhart—worst snow—worst drift—worst cold—worst of the season. Wabash—blizzard—blocked—black eye to railroads—report from Granger 28 freight and two passenger trains stuck within a distance of 100 miles.

Minnesota and Dakota.—The worst pill in the box. Trains abandoned. Thermometer, Minneapolis—14° below. St. Paul goes Minneapolis one better, and by way of a clincher, claims 34° below in the last 24 hours—no mails from Dakota.

Iowa.—Dubuque—cuts all full—one train stuck at Blairsburg—one also at Fort Dodge—freight trains abandoned—thermometer 30° below.

Wisconsin.—Milwaukee—we feel that it is coming, but so far we are happy—come round to-morrow—only 18° below so far.

It was a cold day, but somehow few got left.

"How Bell Euchered Gray." The *Tribune* of the 20th contains a column and a-half on the above subject, apropos of the approaching hearing of the United Swindle *vs.* Bell, which is set for the 24th inst. Nearly the whole article, which is a Washington special, may be summed up in the balance of the headlines, which are : "A little underground railroad given as his sharpest weapon. It ran from the office of his attorney's to the patent office, and was useful in getting at the Western inventor's papers—at least, the brief of one of Gray's lawyers says as much. The great cases ready for trial." Four revelations are promised in the brief of Mr. Lysander Hill, of this city, who is one of the attorneys opposed to the Bell Company. These "revelations" all bear upon the point claimed and foreshadowed in the headlines quoted above.

In addition to all the well-heralded troubles which are about to fall upon the head of the Bell company, and which everybody has heard more or less of, there still remains one fatal crushing blow which, when the rest of the little men have done pinching and pounding and slapping this Gulliver of the telephone business, is coming to the front with a sledge hammer blow which must end in complete annihilation. The man lives in Chigago from whom Bell was seen to steal the idea of a diaphragm, if not even the original notion of a carrying wire !

On the west side there is a neat comfortable little boarding-house hotel called the St. Caroline's Court. On Friday the 22d, the entire house was captured, and the regular boarders set one side by the female hullo fraternity. The girls for the time being owned the entire establishment. The occasion was a ball by the J. O. Y. club. What in the name of a broken switch those mysterious initials mean was a deep mystery. The club is composed of the lady operators of the Chicago Telephone Company, and after a deal of mental cudgeling it has finally leaked out—no, the number of the girlie who gave it away shall not be made public—for general use it is "Just One Year." But as is common in mystical circles there is a further significance. In just one year the girls will, by the prerogative which falls to them about every fourth year, have a chance to make the young men stand, while they pop the question, don't ye see ? The club, composed of twenty young ladies, has its headquarters at Central Office No. 2, at 125 Lasalle. To say that the girls and their escorts had a jolly, rich time may be inferred from the fact that the boarders and other people in the house were contented to sit, stand, or lie around, like bumps on logs until two o'clock in the morning, while the fun went on, without a murmur.

There was good sleighing a few nights before that, and the excellent service given by office No. 6 to its customers generally, brought from one of its contented subscribers a short time ago an offer of a big sleigh, with four horses and a driver attached, for any evening selected by the manager, who pitched on the 19th.

If ever a lot of girls had a rousing good time the evidences go to prove that Miss Nichols and her friends had it that evening.

In the crowd, to be made use of if occasion required with a sort of honorary membership, without a vote, there were six of the gentleman style of humanity—among whom were two ex-telephone men and two little boy brothers; these and only these to twenty-three girls, telephone and otherwise.

Did a gentleman propose refreshments, he was quietly but positively informed that he was a guest. Would some rooster in the party venture an expression that it was time to smoke, and he would have to stop a minute for matches at some place where it might be possible to get a tray full of lemonade, the proposition was met with a suggestion that matches were on the regular bill of fare, and in a deep dress pocket, beneath sundry articles of office furniture, such as pliers, screwdrivers, binding posts, etc., there were matches.

The fellows quieted down, outwitted by the ladies, and simply enjoyed the ride, though they still threaten to get even with the girls if it takes till leap year to do it.

Chicago parties were granted several patents on the 18th instant. There was one for a "skiagraph;" Jas. F. Munsie, underground conduit for electric conductors; W. R. Patterson, three for cables and insulating the same; C. E. Scribner, dash pot for electric arc lights.

The Lake View Electric Light Company was incorporated on the 17th; stock, $100,000. Incorporators, Wm. V. Vogel, Herman Koeppe, William Kramer. Lake View is a township in this county, next outside of Chicago.

The annoyance and threats of water famine arising from ice, as well as a necessity for a greater supply at some seasons of the year, has resulted in the project of a shore conduit 1,800 feet in length, similar to the tunnel which extends out to the crib.

At the outer end of this, where it will take water from the lake, a lighthouse 75 feet in height will be placed, together with a 1,000 pound bell for fog signals.

From the water works, on Chicago avenue, three cables will be run to this point, one large and two smaller ones.

The plant at the City Building at present consists of two 250-light, and two 350-light Edison dynamos. A change in this plant will increase its capacity about 500 lights, and the two smaller dynamos will go, one to the Chicago avenue water works, where, in addition to lighting the building, it will feed a group of ten 50 candle-power Edison lights at the outer end of the new tunnel, and also run a small motor which will ring the fog bell when necessary, and the other generator will go to the West-side Water Works for lighting the building.

Prof. Barrett has contracted for a six light dynamo for the fire boat Geyser, of which the entire department is so justly proud. These lights will be distributed as follows : One each at stem, waist and stern of the boat—the equivalent of one arc in incandescent lights throughout the boat. The remaining two will be placed on portable tripods with flexible attachments, to light up the battle field.

The Western Electric Company report recent work as follows in Ohio : A fifty light plant at East Liverpool, and an addition to the Steubenville plant bringing it up to 100 arc lights ; a thirty light outfit for Tampa, Fla.; a similar plant for Washington, Kansas, and one of the same size as an addition to an existing plant at Concordia, Kansas.

The Edison people here have made up a statement from whence the following figures are taken, which should be a very comforting sort of showing to their stockholders.

Central station installed by the Western Edison Light Company from July 1st, 1882, to close of December, 1886 :

Illinois lights		2,880
Iowa "		6,900
Wisconsin lights		2,750
		12,530

ISOLATED PLANTS.

Illinois lights	26,012	
Iowa "	2,350	
Wisconsin lights	7,487	
	35,849	
Outside territory lights	1,446	
		37,295
Total lamps		49,825

In the Kansas Legislature a bill has been introduced, providing that the Railroad Commissioners shall have the same power over telegraph lines they now have over railroads, in reference to rates, facilities, etc. It had got no farther than the Senate on the 19th.

CHICAGO, Jan. 25, 1887.

BOSTON ELECTRICAL NEWS.

The Harvard College Library is to be open in the evening instead of closing at 5 o'clock or at sunset, as has hitherto been the case. Lights in multiple series, operated from the Cambridge Electric Light Company's station (Weston system), will be used.

"Dynamo machines," said an experienced engineer a few days ago, "as manufactured in this country, are far ahead of anything built in France. Gramme ring dynamos built in that country have in many cases immovable brush carriers and no fastening for the armature, except a piece of wood."

There is need of an electro-dynamometer as sensitive as a Thomson mirror galvanometer. The study of earth currents has not been fruitful in results, owing to the need of a measuring instrument for weak, alternating currents.

Peck & Hall, wholesale dealers in hides, South street, are having their new building fitted with freight and passenger elevator. A 10 horse-power Sprague motor runs continuously, and to it are belted the hoisting machinery for the two elevators. The motor is self-regulating, and takes current only in proportion to the work done. The elevators start more promptly, and have a steadier and easier motion than most of their class. All the machinery, except the motor, was built by the Whittier Machine Company, to whom belongs much of the credit of this successful installation.

A gentleman who has spent some time in Europe in the study of electrical interests, was asked the reason for the slow growth of isolated incandescent lighting in Paris. He said that nothing more than a two-inch plank was allowed to be placed over a steam boiler. There was a strange idea that a boiler on exploding rose in the air and fell in exactly the same spot, and that if there was anything heavy enough in the way to prevent this intelligent action on the part of the bursting boiler, much damage might be done. So much valuable space is required for a steam plant that efforts have been made to popularize the use of the gas engine for electric lighting.

Places on the Street Railway Committee of the Legislature have been actively sought. There are already four petitions before this committee for charters for elevated railroads in Boston. It is expected that the committee will visit most of the cable and the electric roads in the country. Capt. Meigs is expected to obtain some extension of the rights granted him in his charter of three years ago.

On the arch of the doorway of one of Boston's theaters was a row of red, white and blue lights. One evening as the proprietor himself stood in the doorway, a passer-by remarked : "This looks like the Oriental tea store." Sequel: The lights were removed.

The senior electrical engineers at Tuft's College are engaged in the construction of a dynamo for electric lighting.

Counting all the losses to life and property the world over from electricity, and they will be outnumbered by damage caused by gas in this vicinity. From 75 to 100 feet of sidewalk on Essex street was torn up by an explosion of gas a few days ago. There is at present no method by which a leak in a gas pipe may be discovered and located from the gas office or works. On the other hand, an electric system is under complete control and supervision.

The directors of the Concord Gas Light Company voted to establish an electric light plant there immediately.

Mr. R. J. Monks, of Boston, will deliver an address on "Artificial Light," in Sleeper Hall, Boston University, Somerset street, Friday evening next. The lecture will be open to the public.

At a recent meeting of a large number of the electric lighting companies of Massachusetts, an organization was affected. The association is called the Massachusetts Electric Lighting Association, and its officers are: President, James F. Almy, of Salem; vice-presidents, D. L. Mitchell, of Taunton, and Jerome W. Hyde, of Springfield; treasurer and secretary, H. Burr Crandall, of Boston; executive committee, Edward S. Sears, of Boston; H. H. Fairbanks, of Worcester, and J. D. Flint, of Fall River.

When the Board of Gas Commissioners was created in this State it was the general opinion that a few more sinecures had been provided for some favorites. To the surprise of almost every one they have gone up and down the State working hard and doing much to promote the interests of gas producers and consumers. They have given instructions in methods of book-keeping to some companies, and have explained the reading of gas meters to many consumers. Two companies failed to earn expenses, and seven others did not earn enough to pay a dividend. Less than 8 per cent. of the receipts were for residual products.

The methods of using petroleum oils for enriching coal gas have for a number of years been used by gas companies. The coal tar produced does not have the same properties, and is not worth as much as that produced when coal alone was used in the manufacture of gas. It is likely that there will be a further depreciation in the price of residuals.

It does not seem probable that there is more than an attempt to sound public opinion in the proposition to run street cars through the common and public gardens. Washington and Tremont streets are now taxed to their utmost capacity by the traveling public. The business center is moving rapidly southward, and in a few years will reach Boylston street. The West End Railway Company has been practically refused permission in advance to any petition for right to lay tracks on Park street and Beacon street, near the State House. The heavy grades at this point make it impossible to use horses.

BOSTON, Mass., Jan. 26.

Telephonic News

*** Telephonic trials made last week with the newly established wires between Brussels and Paris were perfectly successful.

*** A young woman in a telephone office in a Western town has resigned her position, because an irascible customer shouted "Hello" backward to her.

*** The telephone is making slow progress in England. While in 1885 there were 325,574 telephones in use in the United States, in England there were only 13,000.

*** The suit in the superior court of the Cumberland telephone and telegraph company against a majority of the members of the city council, of Evansville, Ind., for $7,500 damages, by cutting down the wires and poles of the company, ended last week in a judgment of $600 against the city.

*** At Burlington, Iowa, the telephone company is putting up a 100-wire cable on Third street, which improvement in the matter of lessening the number of aerial wires greatly pleases the Burlingtonites. A line connecting Burlington with Galesburg, Peoria and all intermediate points is also being constructed.

*** The annual meeting of the stockholders of the Missouri and Kansas and United Telephone Companies will be held this week (Jan 26th) at Kansas City, Mo., at which time action is to be taken on the matter of the increase of stock in the former company and the consolidation of the United Company with the Missouri and Kansas.

*** The American Telephone and Telegraph Company have now the system of metallic circuits between New York and Philadelphia connected with the telephone system of the latter city. This means that any subscriber to the telephone exchange in Philadelphia can call for any subscriber in New York, Brooklyn and Jersey City, and talk with him satisfactorily. The company has prepared lists of the subscribers of the cities named, and will send a copy to each Philadelphia patron of the long lines. Several direct wires have been leased for a year by brokers in the two cities, and Wanamaker, of Philadelphia, has recently had a cabinet set put in exclusively for long-distance use.

An Important Decision in Canada.

Chief Justice Wilson, of Canada, in a recent decision grants an injunction against the Belleville Electric Light Company compelling them to remove four of their poles to the opposite side of the street from those of the telephone company. This will be interesting as being the first decision of the kind in Canada. The decision concludes as follows: "The fact that the city engineer located the defendants upon the side of the road in question will not give the defendants an indefeasible right to maintain their poles and wires as against the plaintiffs upon the side so assigned to the defendants. The plaintiffs had the prior right, they have always opposed the defendants' right to have their poles where they are, and the City Council had not the right to destroy or prejudice the privilege they had already granted to the plaintiffs. I think the plaintiffs are entitled to the relief they ask, and I am glad to say it cannot be a very serious matter to the defendants if the whole of the cost of transferring their wires to the other side of the road will cost only about $10. In my opinion the defendants must be ordered to remove their poles and wires to the other side of the road in question, that is to the side of the road on which the plaintiffs have not their poles and wires, and that the defendants do pay the costs of this application. The order will be in the usual form to proceed with the trial of the action to pay damages, etc." Defendants accept the above judgment as final, we are informed.

The Rochester Telephone Situation.

To the Editor of Electrical Review:

It is two months to-morrow since the telephone war was commenced in Rochester, with no indications of a compromise. Instead, active preparations are being made to place a competitive exchange, operated and controlled by the Subscribers' Mutual Company. To add to the annoyance the telephone company are put to, a decision, I anticipated in my last, has been rendered against them. The decision was handed down by Judge Rumsey. The subject is the injunction brought by the Bell Telephone Company against the Executive Board. By his decision the temporary injunction protecting the pole, at the corner Union and Court streets, is vacated, and the motion for a permanent injunction is denied with costs. As the opinion had not been put in the hands of the Executive Board yesterday, that body was unable to state what action it would pursue. Below is the opinion in full which was received late last night by special dispatch:

"It is necessary to state only the conclusions which I have reached as the result of the discussion on this motion:

"First—That the plaintiff is properly organized under Chapter 265 of the Laws of 1848 and the acts amending that law. Attorney-General *vs.* Edison Telephone Company, 6, Q. B. D., 234. Wisconsin Telephone Company *vs.* City of Oshkosh, 62, Wisconsin 32.

"Second—That under the powers conferred by that act the plaintiff acquired the privilege of erecting its poles in the streets of the city of Rochester without the consent of the authorities of said city, providing the said posts do not incommode the public use of said streets. 2, R. S. 7th Ed., 1,720, Sec. 5, Weed *vs.* Atlantic & Pacific Telegraph Company, 71, N. Y. 81.

"Third—That the so-called contract between the plaintiff and the city of Rochester, giving permission to the plaintiff to erect its poles in the streets of the city is not effective as a grant, because the city has no power to grant the right to any person to maintain a permanent obstruction in the streets. Ely *vs.* Campbell, 59 How. Pr. 333.

"Fourth—That if valid at all, it was merely a license and revocable at any time, and that the subsequent resolution was a revocation so far at least as to poles sought to be subsequently erected. St. Vircent, Female Orphan Asylum *vs.* City of Troy, 76 N. Y. 108; Babcock *vs.* Utter, 1 Abb., Ct. of App., Dec 27th.

"But the abrogation of such license did not effect the right which the plaintiff acquired by the statue above cited.

"Fifth—The act, threatened to be done by defendants being a mere trespass cannot be restrained unless it will cause irreparable injury to the plaintiff. Livingston *vs* Livingston, 6, John, C. H., 497, 1 High on Ju. J., Sec. 701.

"Sixth—That upon all the papers it does not appear that the removal of this pole will work an irreparable injury to the plaintiff or to its business. I do not decide whether or not the pole placed as it is incommodes the public use of the highway. The affidavits presented by the defendants tend strongly to show that in view of the situation of the pole and its surroundings and the obstructions which had previously been placed in the street in that vicinity the public use of the highway may to some extent be incommoded. If that be so the pole should not stand there, and the defendants would not be trespassers if they removed it. But I do not think that question is here. Upon the whole case as presented by the papers it seems clear that the threatened removal of the pole will cause no more than a temporary inconvenience to the plaintiff and that a case is not made for the interference of a Court of Equity."

On this decision being rendered, Vice-President Hall, of the telephone company, asked the Executive Board to delay action. Subsequently, the pole was moved by the telephone company to an open lot.

The Mutual Telephone Company have incorporated themselves, and filed articles here and at Albany, to be known as the Western New York Mutual Telegraph and Telephone Company; shares, $50. Each telephone is entitled to one share only. At this writing $534 has been subscribed for expenses, and one-half paid out.

The writing telegraph attracts a great deal of attention, and certainly is a very ingenious machine. It consists of a writing lever, on which the imaginary letter is written; this lever controls two resistances in connection with two electro-magnets. The movement of the writing lever varies these resistances, varying the attractive force of the respective magnets. The armature for the magnets controls the pen. The pen is fed by a fountain. The pen at the receiving station should move in unison with the transmitting instrument. I should say, from my experience, it will require considerable practice to become an expert or even a legible writer, and I pity the poor crank who writes a poorer hand than I do.

I think I can safely say the telephone will not have a competitor in the writing telegraph. However, the machine is a very ingenious one, and is "fully covered by patents." The arrangement is very much like one described by Prescott—a machine invented in England some years ago.

Mr. Meyers, of the Syracuse exchange, was in town a short time ago looking over the field here. He will be without instruments on the 28th instant, and has promised his people to furnish them as good a system as they have had in the Bell. He does not state what telephone he will use. Nothing has been done by the Council toward granting a franchise to the Utica Telephone Company, who the Bell Telephone Company elected to succeed Mr. Meyers, and the prospects are there won't be at present. Meantime, to keep the matter before the public Messrs. Dan & Lapp have sent a communication to the Syracuse subscribers, asking them to use their influence in delaying action by the Common Council.

The above-named gentlemen are like Banco's ghost—they will not down. They have sent a letter to the Buffalo Council *apropos* the communication of the Buffalo Bell Telephone Company, asking permission to go underground. Dan & Lapp petition the Council to delay action, giving as their reason the belief that the Bell Company ask permission of the Council, with the intention of intrenching themselves so firmly that a competing company would find difficulty in gaining admittance.

On the reassembling of the State Senate last week, several bills were presented providing means to regulate telephone charges in the State of New York. The first bill provides charges shall not be over $3.50 for one telephone, and not over $2.50 for more than one. A second bill was introduced fixing charges at $6.50 in cities of over 500,000 inhabitants; $3.75 in cities of 100,000 to 500,000 inhabitants; $2 50 below that number. Verily, the good work goes on.

The Bell Company, Rochester, have begun stringing cables in place of the wires now up on Main street. The Executive Board say nothing can be done in the matter.

Thirty telephones were delivered to a man named Norton recently. H. T.

Rochester, N. Y., Jan. 20.

Hunting Telephone Information.

Hon. John Strecker, of Washington county, is the member of the Ohio legislature, who was in Indianapolis recently seeking telephone information. He is the author of a bill now pending in the Ohio general assembly to regulate the telephone system in his state, and the report which he carried home was not flattering to the success of his own measure. He found in Indiana great dissatisfaction with the present law, and that the business community, which regards the telephone system a necessity, openly assert that unless the law is repealed, it will bankrupt them. He was also informed that some of these business firms were now paying $72 80 per year, on an average of four calls per day, when under the old law they were charged but $5 with an unlimited number of calls.

Special Report Made to the Board of Brooklyn Subway Commissioners by Professor Plympton, its President, as to Telephone and Telegraph Systems in European Cities.

At a meeting of our board held in July last, it was deemed desirable that a personal examination by some member of this board should be made of the telegraph and telephone systems of European cities.

In accordance with the terms of a resolution passed on the 8th day of July, I left New York for Liverpool on the 21st of that month, arriving in Liverpool on the morning of the 29th, and reaching London on the evening of the same day.

Some letters of introduction to Mr. Preece, the electrician of the British Postal Telegraphic service, secured for me the cordial and polite attention of the chief himself, and the very efficient aid of the officials in charge of special departments of the service. No extensions or repairs of the lines were in progress at the date of my call; but I was invited to examine the construction of the conduit pipes and the cables they contain, so far as they were accessible at the "working boxes," or "man-holes," as they would be called in America. Accompanied by Mr. Fleetwood, an electrician of the Postal service, I examined several of these "boxes," which had been opened by his order for the purpose.

The covers are fitted very tight, and are flush with the pavement of the sidewalk. In two instances the workmen failed in their attempts to pry them off. The "boxes" are shallow, scarcely two feet deep, and only sixteen by twenty-four inches in lateral dimensions. The conduit pipes are of cast-iron, and mostly of three inches in diameter. Into these pipes the insulated wires in a loose bundle are drawn; gutta percha is the only insulating material used. The wires are for telegraphic service almost exclusively; only a few telephone wires, and these for the use of the Post Office, are under the pavements. Telephonic communication in London is furnished by the system of the United Telephone Company, whose wires are all supported overhead by house-top fixtures. The right to erect the fixtures is purchased of the owner of the property.

Experience with underground telegraph lines is not new in England. Before 1845 such lines were placed underground; but they soon failed, and pole lines were substituted. Again, in 1853, the Magnetic Company of England laid wires for telegraphic purposes in creosoted wood, buried two feet in the earth. The insulation gradually failed, and again the system was replaced by one of poles.

A section of the conduit used at this time was shown me by Mr. Preece. It was a trough-shaped block, about four inches wide, and perfectly sound, although it had lain buried at shallow depth more than thirty years. Iron pipes are now preferred, solely because of the protection they afford against the blows of pick-axes and shovels of careless workmen—a protection which seemingly might have been secured by a heavier conduit of timber.

Mr. Preece said he knew of no case of decay of well creosoted timber.

From London I went direct to Brussels, where I arrived on the 2d of August. To Messrs. James F. Meech and George Cutter, both of the International Electric Company, I am indebted for much valuable aid in getting desired information. These gentlemen are engaged in superintending the erection of the Thomson-Houston system of arc-lighting. Their operations during the present year have extended as far east as Russia, north to Sweden and Scotland, and south to Italy.

The acting superintendent of the telephone service in Brussels is Mr. E. Bartelyou, who kindly gave me the details of the system. The wire used is a phosphor-bronze wire of 1.4 millimeter diameter (or about No. 17 gauge). Its strength admits of long distances between the supports, which are all on the house-tops (no wires of any kind are underground in Brussels). In a few places there was a clear space of 270 meters, or 885

feet between the supports. No stretching or breaking had occurred in these long stretches, although the wires had been in place for three years.

The managing director of this company is Mr. De Groot, whose principal office is in Antwerp. As I had brought letters of introduction from personal friends of Mr. De Groot in New York, and as the franchises of his company include the telephone systems of Brussels, Antwerp, Stockholm, Milan and Turin, I went on to Antwerp without delay. All my inquiries regarding electric systems in the above cities were kindly answered. All wires of all kinds, in the above-mentioned cities, whether for telegraph, telephone, or electric lighting are above ground. In the Northern cities they are on the house-tops, and in Italy partly on the house-tops, and partly upon brackets along the sides of the buildings. Two exceptions to this general rule were mentioned. One was a short circuit for electric lighting on the Edison (incandescent) system buried in Turin, and the other was a new line of telephone wires supported on poles in one of the streets of Antwerp.

Rights to erect fixtures on house-tops are purchased as in England. The price in Belgain cities is about 50 centimes (10 cents) per wire per annum. The more recent supports for wires are of wrought iron, and are of somewhat ornamental design. The overhead wires are thickly clustered in some portions of Antwerp and Brussels, but being of smaller diameter, are not so unsightly as the same number would appear in American cities.

I went on into Germany on the 6th of August, making brief shops at Cologne, Wiesbaden, Frankfort and Heidelberg. Telephones are not much used in these cities; only 500 in Cologne, 464 in Wiesbaden 430, in Frankfort, and less than 100 in Heidelberg. All the wires for these systems are supported overhead on house-top fixtures of rather rude patterns. The military telegraph is underground. All others are in the air. In Germany, as in England, the buried systems were tried early. The first ones failed at once. Upon the discovery of the insulating qualities of gutta-percha by Dr. Werner Siemens, in 1846, new experiments were tried with underground systems. A line of four or five miles in length was laid between Berlin and Gros Beeren in 1847. As this appeared to be successful, the experiments were continued until more than 3,000 miles of gutta-percha covered wire had been buried in the ground. This worked well for a few years, but finally failed entirely, and a line on poles was substituted for it.

The telegraph wires now buried in Germany are in bundles forming cables, known as the Siemens' cable, each wire being separately insulated, and the whole protected by a spirally wound heavy wire, which shields the conductors from ordinary injuries. It is an expensive cable, and is better adapted for the military service, for which it is chiefly employed, than for the wants of a commercial community. That its use is thus restricted in Germany is pretty well indicated by the fact, that wires on poles stretch along every mile of railway throughout the empire.

I arrived in Berlin on the 9th of August. As telegraph, telephone, and two kinds of electric lighting systems are used in the city, I sought information at several points. The telephone used here is a German invention, differing somewhat from the familiar Bell pattern, and declared to be unsatisfactory by those who were accustomed to use the latter.

Both the telegraph and telephone systems belong to the Government. The telephone wires are carried on house-tops upon light iron fixtures, much like those in Belgium. The house-owner is paid an assessed compensation for the occupation of his premises, but he is obliged to submit to it.

An electric lighting company have buried cables along several streets of the city. The engineer of the company gave me the following list of rules imposed by the Imperial Government upon their work in the streets:

"The electric light cable must be enclosed in an iron pipe, whenever it is buried within one meter of, and parallel to, a telegraph cable."

"In case of the crossing of the two systems, the electric light cable must be at least 45 centimeters (17.7 inches) distant and above the telegraph; and moreover must be covered with an iron pipe for at least two meters each way, from the point of nearest approach."

"Whenever an electric light conductor is laid in a street, where there is no buried telegraph, such conductor is to be placed under the sidewalk, but at least two meters from the house line."

I visited the Siemens' establishment, but was unable to meet Dr. Siemens, to whom I had a note of introduction. He was out of town. The manager of the works in the city, kindly offered to answer my inquiries, and to act as interpreter in an interview with their engineer. In course of the conversation, on two separate occasions, I was told that although they knew of the questions arising in America, regarding safe limit of proximity of wires for different kinds of electric service, they were not prepared to express an opinion on the subject. They knew of no experiments with the quadruplex telegraph, and the high tension alternating currents for arc-lights were not regarded with much favor, and were not in use in Berlin.

It was understood that the government telegraph officers had been trying some experiments bearing upon the solution of these questions, but with what result was not known.

From Berlin I went south, arriving at Munich on the 13th of August. An official at the telegraph station connected with the post-office, informed me that all the lines were on house-tops. The number of telephone subscribers was 730. The Morse system of telegraphy was used, and the German telephone.

In Lucerne, my next resting place, the telephone is but sparingly used. Wires are upon light fixtures on house-tops.

In Milan, where I arrived late on the 16th of August, I was fortunate in meeting Mr. Strugnell, an electrician of the International Electric Lighting Company, who at once interested himself in the object of my visit, and rendered important service. Milan has about 800 telephone subscribers. All the wires are above ground, a large proportion of them being under the eaves, attached to bracket fixtures. The reason for this departure from the common European practice is found in the triple system of tiling on the roofs.

The Edison, the Siemens', and the Thomson-Houston systems of electric-lighting are all in use, with overhead wires only, and seem likely to extend rapidly. Some complaints had just been made against the Thomson-Houston system, on account of induction effects due to its high tension current.

An effective system of street lighting is in practice here. Arc lights of good intensity are suspended over the middle of the street from high brackets attached to the buildings on both sides.

I visited Venice and Turin, but found no features essentially different from those of Milan. The systems of all kinds were only of less extent.

I reached Paris on the 21st of August. Having letters to M. Berthon, the well-known electrician and inventor, I went directly to the offices of the telephone company in Rue Caumartin. I was cordially received and invited to ask as many questions as I liked. In response to my inquiries, M. Berthon gave me, in substance, the following information:

There were in Paris at that date about 4,400 telephone subscribers, and about 2,200 in all the rest of France. In Paris, telephone wires are made up into small cables, and conducted through the sewers, being held in place by small hooks, the shanks of which are driven into the masonry joints. If the sewer ends before the destination of the telephone cable is reached, the cable is immediately run up to the house-top and conveyed overhead, as in other European cities. In other French cities, the wires are all above ground, except in Bordeaux, where 400 subscribers are served through a system drawn through iron pipes under ground, but at the date of my visit the system was not working very well. Two hundred of the Paris subscribers are reached by wires above the houses, because there are no large sewers in which to suspend the wires.

No electric lighting wires are permitted in the sewers. Indeed, there are but few electric street lights in Paris. There are less than there were five years ago, and what there are, are all overhead.

In both London and Paris, all arc-lights are within short distances of the current generator, which is generally a dynamo driven by a gas engine.

M. Berthon expected his company would undertake the telephone service for the principal cities of Spain. He proposed to exact as a condition, the right to carry the conductors upon the house-tops, employing a metallic telephone circuit, and cables of a small number of wires in each.

In traversing the sewer under the Avenue de l'Opera, I found two groups of telephone conductors of twelve cables in each group, fastened securely to the arched top of the sewer, while brackets on the sides supported a pipe carrying telegraph cables, a gas pipe of six inches, and a water pipe of sixteen inches diameter. When the telegraph cables reach the end of a sewer, they are continued on underground, in three-inch iron pipes.

Leaving Paris on the 25th of August, and spending two days in London to make some further observations upon lines in the suburbs, I continued on to Newcastle. This city enjoys the reputation of having buried almost its entire system of telegraph and telephone wire. The telephone service is not very extensive, as the number of subscribers is not quite 600, and is increasing but slowly, some 25 to 30 between January and August. Nearly all the subscribers moreover are within a circuit of a half-mile radius.

Through the kindness of Mr. Heavyside, I was permitted to examine, in company with an inspector, the central office, and the entire system of distribution.

The arrangement of conduits and street "boxes" (corresponding to our manholes) is much like that in London. The boxes are 10 inches by 26, the pipes entering at the narrow ends. Pipes of 2, 3 and 4 inches diameter are employed. When the number of wires in any pipe is to be increased, the entire contents of the pipe are drawn out, and the new lot drawn in. The wire used is No. 18 copper wire, with a wound covering, whose outside dimensions are those of No. 7 gauge

The wires are bound together in sets of four, the pair which form the circuit being twisted together with much care, to avoid induction from the neighboring pair.

As prominent electricians have expressed the opinion that, when a metallic telephone circuit is employed, the limit of distance of telephone communication underground is about 10 or 12 miles, I was quite desirous of testing the question. The privilege was cheerfully granted, a line was connected for my use that extended through 12½ miles of underground wire, and continued thence over a pole line of 38 miles further—an entire length of 50½ miles. The result was satisfactory in every way. During a conversation of several minutes, there was no call for a repetition of a word.

As a summary of the observations made during this short tour, the following are offered as conclusions fairly drawn from the information obtained:

The problem of construction of a telephone system on such a scale as exists in American cities with underground wires has not yet been solved abroad. In Europe no attempt has been made to solve it, because as yet there is no such general use of the telephone. The number of telephones in the United Kingdom of Great Britain, reported on January last, was 13,000, while in the United States, at the same date, there were 163,500. There are more telephones in use in New York city and Brooklyn than in all Great Britain; more in New York city alone than in all France

For the accomplishment of the ultimate object of converting our overhead electric systems of all kinds to underground systems, without impairing the efficiency of their service, without permanent injury to our streets, and without increasing the cost of the service so as to prevent the use of the same, we must depend upon the experience gained and experiments made on our own side of the Atlantic.

TELEGRAPHIC

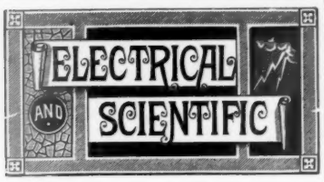
.... The Western Union Telegraph Company, besides its great business of transmitting private and news despatches paid for by its customers, is also engaged in furnishing news, chiefly of a commercial character, to such persons as are willing to pay for the service. One of the cardinal principles of the telegraph business is that a despatch sent by a customer is sacred, and its contents must never be revealed under any circumstances. The Western Union once refused to make public private dispatches even when ordered to do so by Congress. A telegraph operator who reveals the contents of a despatch, the company claims, is discharged in disgrace and can never be similarly employed again.

.... It was charged last week that the Commercial News Department of the Western Union had stolen private despatches intrusted to that company and had furnished them to its news customers. This serious charge was the occasion of the deepest interest in Wall street yesterday. The accusation is the result of a discovery made by Dow, Jones & Co., financial news agents in Wall street, that private despatches sent to them by one of their correspondents were printed by their rivals in the business, John J. Kiernan & Co., even before they were delivered to Dow, Jones & Co. W. B. Somerville, the superintendent of the Press Department of the Western Union Company, said that this was a serious matter, not only for Dow, Jones & Co., but for the Western Union, and he promised to lay the matter before President Norvin Green. Later in the day Mr. Somerville called upon Mr. Jones and informed him that President Green had ordered that the most rigid investigation be made, and that pending this investigation the operator through whose hands the despatches passed had been suspended.

.... A letter has been addressed by Mr. Erastus Wiman, the president of the Great North Western Telegraph Company, to the shareholders of the Montreal Telegraph Company, stating that after an unavoidable delay of two weeks the drafts for the dividends due the latter company on the 1st inst. had been transmitted to the treasurer of the Montreal Telegraph Company. Mr. Wiman writes: "However far we may have failed in our duty to the Montreal Company by these few days' delay, it has utterly and completely failed in its duty to us. It has failed in its duty to us by months of dilatoriness, its hesitating policy and the utter want of appreciation of its obligations to maintain us in the possession of property for which it demands payment. It is greatly to be hoped that by some arrangement the telegraph property of the country may be saved from the disaster which now seems to threaten it. The expensiveness of competition, which in telegraph business is greater in proportion to its earning power than in almost any other department of human activity, must be borne by someone.

....An exhibition was given in Boston last week at City Hall of Rogers' system of auxiliary fire alarm in the presence of members of the fire department, insurance men and others. The system is an electric contrivance by which an alarm may be sounded from any part of a building by means of the nearest box to the premises. The box is connected by a wire to a push button in any building or room of a building. When a fire is discovered it is only necessary to push the button, and the alarm is sounded from the box on the street nearest the fire. By this arrangement the time taken to run out of a building and to the nearest box is saved The system is the invention of Superintendent Rogers of the American Screw Company of Providence, and is the result of careful study after the disastrous fire in the company's works. Experienced men speak of the system as something long wanted, and as the mechanism is said to be perfect, and only one alarm can be given at the same time from the same box, property owners will have a further protection from serious fires.

A. C. B.



* * The Railroad Electric Car Lighting Company, at Chicago, has been incorporated with a capital stock of $100,000. Incorporators, J. I. Veeder, W. Rossiter and William Rheem.

* * The Gray Telantograph Company, at Chicago, with a capital stock of $10,000, was licensed a few days since by the Secretary of State. The incorporators are, Elisha Gray, N. E. Swartwout, and M. L. Willard. The basis of the organization is an invention of Dr. Gray's, the purpose of which is autographic telegraphy. The Professor has for some time had his idea, but past experience has taught him that all these little things get away if not carefully guarded, and so he has kept this particular invention from the vulgar gaze of the outer world. It will see the light, all in good time.

* * In the case of Norman *vs.* Ricketts, lately decided by the English Court of Appeal, it appeared that the plaintiff, a milliner in London, sent to the defendant, a customer of hers in Suffolk, a letter saying that she would be obliged by the favor of a check within a week. On receipt of the letter the defendant drew a check payable to the order of the plaintiff and posted it to her address. The check was stolen in transit and was paid by the defendant's bankers, the thief having forged the plaintiff's indorsement. In an action to recover the amount the defendant pleaded payment. This plea was sustained by the Court of Appeal. The Master of the Rolls, who delivered judgment, said that the rule of law required the debtor to go and pay his creditor, but that where the creditor asks for payment by check and by post, posting a check to the right address is payment, though it never reaches its destination.

* * Says the *Tribune* of this city: Daniel Hungerford, of Connecticut, is well known uptown, where he is usually a guest at the Hoffman House. His line of business is the manufacture of copper wire for telegraph purposes. He is a short, stout, well-dressed man, with fat cheeks and pointed chin whiskers, whose twinkling eyes indicate great good humor. Chatting the other day about telegraph extension he said: "Wires are going up all over the country all the time. The biggest thing recently was that Northwest line from St. Paul and Minneapolis, connecting with the Pacific Coast. That was a great undertaking. Iron wire is no longer used, except in patching up old lines. I do not believe the Western Union, if they had to rebuild their system, would put up a pound of iron wire. Of course, they are obliged to use it to patch up old lines. Iron wire that runs 600 pounds to the mile will do no more business than copper that runs from 160 to 200 pounds per mile. Not to mention the difference in the cost of he wire there is a difference in the size of the poles required and the larger burden of keeping up the lines, which is enormous. The iron wires require extremely heavy poles to hold them up. It is only abont five years since copper wire was introduced for this purpose. The first telephone wire was iron, but they are now using copper."

* * A strike of fifty men occurred at the Edison Electric Light Works in East Newark last Saturday. Trouble with the foreman caused the strike.

* * The plant and fixtures of the J. W. Starr Electric Light Company, at Belvidere, N. J., were levied on by Sheriff Van Campen at midnight last Friday, to satisfy the claims of numerous creditors. An attempt to remove the material out of the State by the Schuyler Electric Light Company, of Philadelphia, was frustrated. The works are closed. The citizens are very indignant over the loss of the light.

Putting the Wires into the New York Conduits.

The work of burying the electric wires of New York city under ground began last Wednesday, and sections of cable were laid along three Sixth avenue blocks at a time that the thermometer ranged about six degrees above zero. Promptly at eight o'clock in the morning several immense reels containing the cables reached the southeasterly corners of Sixth avenue and Fifty-fifth, Fifty-fourth and Fifty-third streets. They were easily deposited at the allotted corners by men in charge of the truck that conveyed them to the ground. Soon there appeared on the ground a squad of well-clothed workingmen with an ample supply of tools and apparatus. They looked at the reels already deposited on the corners, and in less than no time got to work at the manholes midway between the various cross streets. It was then just near six degrees above zero and not a single Subway Commissioner was present. The manhole at Fifty-fifth street and Sixth avenue was opened, and then a smaller squad of men was detailed to open the manhole at Fifty-fourth street. All this while people were rushing down the avenue to catch surface or "L" cars, regardless of the great practical work for burying wires just begun.

Superintendent of Construction Hopkins, his beard congealed by icicles of immense proportions, was giving orders all along the line. He stood there fur-capped, in his heavy pea jacket, watching every turn of the wheel, every foot of cable that was loosened from the reel, and his men obeyed him to the very letter. He had just come on from Chicago, and this New York atmosphere was indeed to him a regular "treat"—"Good deal better than over there," he said to a *Herald* reporter.

Not much time elapsed after Mr. Hopkins had his men at the various stations, or rather manholes, before the actual operation of burying the wires began. They were the wires of the Metropolitan Telephone Company. This concern has leased four out of the twelve ducts in the subway conduits already dposited along Sixth avenue, and the Western Electric Company, of Chicago, which constructed the cables containing the telephone wires, was doing the work of drawing them through these conduits, already embedded underground. Hence the presence of Superintendent Hopkins, from Chicago, accustomed to this kind of work. The men under him were picked up in this city.

When the reporter watched the operation of introducing the cables into these Sixth avenue conduits he found that the New York Construction Company had placed a mere wire through the conduits, which had remained there throughout the winter for the purpose of establishing communication from one manhole at the intersection of a certain street to the next manhole at the next intersection. The workmen yesterday just picked up the end of a wire at a certain manhole and attached a manila rope to it by means of a twisted wire. As soon as the old wire was drawn out the new rope was drawn in At the end of that rope the cable was attached. The manila rope was then drawn out, and the result was that the cable was lain in the same duct where originally the single wire was imbedded.

The cables pulled in yesterday were on three reels. They were deposited in the telephone ducts along three blocks, having the following dimensions as to length:

Along Sixth avenue—From Fifty-fifth to Fifty-fourth street, 251 feet; from Fifty-fourth to Fifty-third street, 260 feet; from Fifty-third to Fifty-second street, 271 feet.

The weight of each reel averages 1,510 pounds, and the cable being one and three-quarter inches in diameter contains 100 wires, or, as they say in electric parlance, "conductors." It is what is known as the Patterson cable, the outside pipe being made of lead, making it easy for handling and twisting, as was readily observed by the *Herald* reporter when he saw these cables twisted and turned into the manholes.

Each wire in this cable (there are a hundred of them) is, when made ready for insulation, first covered with cotton thread, then the hundred wires are joined with cotton tape. They are then saturated with melted paraffine, thus forming a cable. After that this cable is drawn into a lead pipe, and paraffine is once more forced with heavy pressure into the lead pipe, filling up the space between the cable proper and the pipe.

The work of burying these cables will be continued from day to day, as they arrive on the ground along Sixth avenue. The workmen were so benumbed by the cold weather the first day that they stopped work earlier than intended. Pedestrians along Sixth avenue, seeing immense reels, looking like hogsheads, lying loose around the east side corners of that popular avenue, now know what they mean, and, further, that the work of burying the wires is going steadily onward.

There is one thing to which Superintendent Hopkins called the attention of the reporter, which, coming from a Chicago man, is a feather in the cap of the New York Subway Commission. He said: "I have opened these manholes after most changeable and severe weather for this climate. I find those which I have opened in good condition, and have thus far met with no obstruction in running my cables through these conduits."

Contact Electricity.

According to a recent paper by Mr. J. Brown, communicated to the Royal Society by Lord Rayleigh, the difference of potential near two metals in contact is due to the chemical action of a film of condensed gas or vapor on their surfaces. Such a pair of metals is similar to a galvanic cell with its electrolyte divided by a diaphragm of air or other gas, and it is the difference of potential of the film that is measured in contact electricity experiments, the metals themselves being at one potential. Mr. Brown has observed that in some cases a change in the constituents of the atmosphere surrounding a pair of metals in contact reverses the difference of potential near them in correspondence with the reversal of electro-motive force that takes place after a similar change in the corresponding liquid electrolyte used with the same metals in a voltaic cell. Such a reversal takes place with pairs of iron-copper when hydrogen sulphide gas or ammonia gas is added to the air surrounding them, and with silver-iron, when hydrogen sulphide is added: neutral or inert gases have little or no effect.

A Little Joke About the First Atlantic Cable.

One day last week an old man with a bald head, and obviously with a drink or two stowed away in the place where a drink does an old man the most good, boarded a Van Buren street car and looked around for a seat. Of course he found none, and, on appealing to the conductor, was told that he would be able to find him one by the time the car reached Western avenue.

"All right, De Soto," replied the aged passenger.

The conductor finished his fare-taking and resumed his perch on the rear brake, but the old man's words kept ringing in his ears. "'All right, De Soto! All right, De Soto!' What the thunder did he mean by that?'" the conductor asked himself, and he finally became so worked up about it that he went in and asked the old man what it was he had been giving him.

"Oh," said the delighted old party, with a chuckle, "in 1858, when the first Atlantic cable was laid, they got a few words across, you remember. One of the messages which came from Valencia, Ireland, in response to an inquiry how the wire was working, was: 'All right, De Soto.' De Soto was the operator's name, you know, and, by gosh, that was the last word they did get through that old cable before she went back on 'em completely. For months that was all you could hear in this country. It was in every man's mouth. Whenever we wanted to say that a thing was all right, when in fact it was all wrong, we'd say, 'All right, De Soto,' see? That was what I meant when you told me I'd get a seat at Western avenue. I know that this car doesn't run any further, and so do you, you young scoundrel!"—*Chicago Herald.*

Digest of U. S. Patents on Storage Batteries.

REFERENCES TO FOREIGN PATENTS OBTAINED THEREON.

(FOURTEENTH PAPER.)

342,358. May 25, 1886. Filed Nov. 15, 1884.
William H. Bemington, Boston, Mass.

Relates to a method of preparing plates before use, whereby they are protected from the injurious action of the acid electrolyte. The preparation of the plates, which is claimed, consists of immersing them in a saturated solution of lead in caustic alkali, and depositing a coating by electric action. The specification contains a description of various metals for electrodes and electrolytic solutions which are not claimed.

342,594, May 25, 1886. Filed Aug. 31, 1885.
Chas. D. P. Gibson, New York.

Describes electrodes formed as inverted cones, arranged horizontally, and alternating in polarity.

Each plate is thickly perforated with inclined holes, which are filled with lead oxide, and the orifices of the holes then closed by hammering. A thick coating of lead oxide is applied to the upper surface of each plate, after the holes are closed.

344,882, July 6, 1886. Filed Aug. 7, 1885.
S. L. Trippe, Denver, Colo.

Describes an electrode plate like in form, consisting of a mixture of lead, sixty-five (65) parts; zinc, thirty (30) parts, and silver five (5) parts, moulded around a wire which serves as conductor through the mass and terminal. The zinc is adapted to be dissolved out by chemical action, leaving a spongy electrode of lead and silver—the lead as the active agent, and the silver as a conductor and binder.

The claim is for any similar composition wherein one of the elements is adapted to be chemically withdrawn, and wherein one of the remaining elements is active and the other a binder.

347,231, Aug. 10, 1886. Filed March 9, 1886. English patent, No. 611, January 14, 1886.
Achièles De-Khotinsky, Rotterdam, Netherlands.

Relates to and claims "a battery consisting of cells, each of which is a shallow box, or tray of wood or other like material, lined with bitumen and sheet lead, and containing parallel troughs of insulating material, in which are laid skeleton metallic frames, all connected at one end to one terminal of the cell, while the other terminal is connected to the lead lining, the skeleton frames, and the spaces between the troughs containing them, being charged with the elements of the battery and the exciting liquid."

347,258, Aug. 10, 1886. Filed May 26, 1883.
Eli T. Starr, Philadelphia, Pa.

Describes a compound battery vessel, consisting of an outer vessel, and a smaller inner vessel, the space between the two being filled with an acid-proof material, such as coal tar.

Claims also electrodes bound together and separated by non-conducting strips, which may extend below the electrodes and insulate them from the battery vessel.

The Telephone Caught the Lost Boy.

"Got any lost boys down there?" called a woman through the telephone as she got Police Headquarters yesterday.

"We've got one."

"What's his name?"

"Why he won't give it. He says that owing to a misunderstanding with his stepmother he has temporarily separated himself from the pa——"

"That's him!" she interrupted, "and I'll be down in about half an hour and wallop that misunderstanding out of him or bust every finger on my spanking-hand! Don't let him temporarily withdraw before I get there!"—*Detroit Free Press.*

* * Charles Morrison, it is now claimed, invented the telegraph before the American Revolution. This gentleman, in a letter to the "Scots Magazine," dated Renfrew, February, 1753, explained his idea of a telegraph, which was to use a wire for each letter, and a suspended pith ball, to be influenced by a charge of frictional electricity from the sending station. What a blessing that Charles's invention died before the Subway Commission!

Construction of Electric Light Stations.

To the Editor of Electrical Review:

When the electric light first began to come into general use, but little was known of the conditions under which a plant could be safely and successfully run. Stations were hastily and carelessly put up, some of which were as poorly built as they could well be, and still hold the necessary machinery, and others were not much better. The lines were run mostly on the "get there" plan, with but little regard to safety. This of course involved a smaller outlay of capital for building and line construction, but proved in the end to be far from economical. Unfortunately, some of these old stations are still in use, although those established more recently are for the most part properly and substantially built.

The construction of an electric lighting station should be similar to what is now recognized as safe mill construction. The foundation and walls should, of course, be amply strong to withstand the weight and jarring which is to a great extent unavoidable, with the high speed of engines and dynamos. The boilers should, if practicable, be in a separate building, and in any case should be separated from the other parts of the building by a brick fire-wall. The floors should be of heavy plank, and all beams left exposed. Counter-shafting is to be avoided on account of its hazard as well as from economy, as there is always a liability to heat in the bearings, with a heavy load on, and a complicated system of belting will enable a fire to spread very quickly. If belting from floor to floor is unavoidable, which is seldom the case, the belts should be in a fire-proof room, separate from the rest of the building.

The leads from the machines must, of course, be at a safe distance apart and should be everywhere in sight and easily accessible. Joints ought never to be placed out of sight. All switches should have a double contact and quick break, to prevent the formation of an arc.

It has been said that a merchant's success may be gauged by the appearance of his desk, and it is equally true that an electric lighting station which is not kept clean and in order may be set down as unsuccessful.

For the protection of other property great care must be exercised in running the lines, and the first requirement is a weather-proof and high insulation of the conductor. The insulation of much of the aerial wire now in use is painfully poor, some of it being absolutely worthless in wet weather. As poorly insulated wire is cheaper than wire well protected, however, it will probably continue to be entensively used.

Lines should not be run through trees, if it can be avoided, as a ground is easily established in this way during wet weather, hard to find, and decidedly dangerous to property. Wires insecurely fastened frequently break from their supports during a storm, perhaps cross other wires, and if there happens to be a ground anywhere on the line, relays and telephones are burnt out, or a fire is started.

Notwithstanding these sources of hazard, aerial wires are decidedly the most practical means of distributing electricity. Burial of the wires means a greatly increased first cost, and on account of the difficulty of proper insulation, a greater expenditure for repairs and greater danger of fire. The proposed subways possess few advantages and many disadvantages. Even if they serve the present purpose, which is extremely doubtful, they cannot for many years accommodate the rapidly growing business of the electric light, the telephone and the telegraph.

The highways of a great city like New York are already much overcrowded with traffic, and some means must soon be provided to relieve them. The most natural relief for this would be some sort of subway—a real subway, not a trench—and several have been proposed during the past few years. The general idea of all is a large tunnel under the street which would accommodate gas and water pipes, and railways for transportation of passengers and freight. In such a subway electric wires of all kinds could easily find a place, and would there have all the advantages of both aerial and underground wires, with few of the disadvantages of either.

W. J. HOPKINS.

Boston, Mass., Jan. 22, 1887.

—— The officers of the Waterhouse Electric and Manufacturing Company, Hartford, Conn., are: Asa S. Cook, president and treasurer; S. W. Bishop, vice-president; Addison G. Waterhouse, electrician; Chas. E. Chapin, secretary; Samuel O. Prentice, attorney. Directors: F. A. Pratt, Chas. E. Billings, Geo. M. Bond.

—— Fred Simmons, of the United States Illuminating Company of this city, while cutting an electric light wire on a pole in front of a building that was on fire, fell head foremost to the ground, and soon expired. He had evidently, in not exercising necessary care in bracing himself on the pole, been jerked to the ground by the attempt to hold the wire when cut. Before ascending the pole, he had taken the precaution to put a "jumper" on the circuit, short circuiting it so that there would be no danger of receiving a severe electric shock. The coroner's jury returned a verdict of death from "electricity and fall." Mr. Simmons was well liked and was foreman of the Fulton street station of the Illuminating company.

—— The investigation into the cause of the fire at the Rhode Island Electric Light station on Saturday morning, by which the engineer and fireman lost their lives, shows the fire to have resulted indirectly from the coal shortage as felt there. Up to the preceding night anthracite coal had been used in the boilers, but being unable to obtain this, soft coal was resorted to, which the fireman was not used to handling. The dynamo room and the room above became pretty well filled along the ceilings and at one end with coal gas, where it was carried by draughts, and an instantaneous combustion followed on the opening of a fire door to bank the only fire not banked. The theory of its originating from the electric wires is thus entirely done away with, and the insurance will accordingly be paid promptly.

The Electric Headlights.

The Cleveland, Akron and Columbus Railway Company has ordered electric headlights for its locomotives. It is a question whether their adoption will not largely avert danger of collision.—*Canton Repository.*

Electric Light and Gas Companies.

The electric light has in many ways proved its great advantages over gas, especially in a sanitary point of view, and is gradually superseding gas in many directions where the latter has been in use. This is recognized by the gas light companies themselves, and as our contemporary, the *Herald*, remarks: "The action of the Boston Gas Light Company in petitioning the Legislature for permission to supply electric lighting to its customers is significant."

It is significant indeed, indicating that this rich and powerful corporation very naturally desires to preserve a monopoly of furnishing light to the people.

Light, water, mail service and telegraphic communication are now public necessities that should not be in the hands of powerful monopolies, who use their privileges to extort all the public will bear in the matter of charges, or who neglect to improve the equality of service or material until forced into it by an indignant community. This we hope our Legislature may consider before hastily giving to any corporation or company privileges by which they may enrich themselves at the expense of the public necessities.

That any corporation should receive a good and fair remuneration on its investments, goes without saying, but in the matter of furnishing the necessities we have mentioned, due caution should be used that the privilege does not get into the hands of any corporation or set of men without being surrounded by sufficient safeguards—such conditions as will prevent public complaint being ignored or the greed of great gains to interfere with prompt performance of duty in furnishing the best material at the lowest price, after insuring a moderate profit to the corporation.

—— Wyandotte, Kansas, has about concluded to adopt the electric light, and a plant of 100 lights is being considered.

—— The Whitewater Electric Light Company, Whitewater, Wis., has been incorporated. Capital stock, $25,000. O. P. Petosy, and others, incorporators.

—— The Uncle Sam Electric Light and Battery Company, Portland, Me. Capital stock, $500,000. President, Samuel T. Holmes, Boston, was organized last week.

—— The Electric Storage Light and Power Company, East St. Louis, Ill. Capital stock, $1,000,000. Sylvanus L. Tripple, and others, incorporators, has just been organized.

—— The Jarvis Engineering Company, Boston, have received the order to set three Zell sectional boilers with the Jarvis patent boiler setting, from the Harlem Illuminating Company, Harlem, N. Y.

—— The Minnesota Time Company has now about 200 electrical clocks, which are ticking out time to the most perfect satisfaction of the dear people. Mr. A. E. Huey, agent of the Edison Company, has latterly closed contracts for a number of plants, both in and out of the city.

—— The Jarvis Engineering Company, Boston, Mass., have received the contract from the Traders, Electric Light Company, Biddeford, Me., for 150 horse-power tubular boiler, a set of Sheffield grates, etc. The boilers will be set with the Jarvis boiler setting, and burn screenings for fuel.

—— It cost the city of Providence, R. I., $31,937.50 for maintaining the electric light service during the year 1886, and the citizens are all greatly pleased with the light. Providence, in truth, is a splendidly lighted city, the lights furnished being divided between the two systems, the United States and Thomson-Houston.

—— The new laboratory of Edward Weston, on High street, Newark, is now complete in all its parts, mechanical, chemical and electrical, and he proposes during the rest of his life to make his profit and pleasure therein. Scientific visitors from abroad and native electricians who have visited Mr. Weston's laboratory declare it to be one of the most complete in all its parts of any private laboratory extant.

—— The shareholders of the Kansas City Electric Light Company will meet in that city at the office of the National Bank of Kansas City, March 7th, for the purpose of obtaining the consent of the stockholders for an increase of stock from $100,000 to $200,000. Under the able and intelligent management of Mr. E. R. Weeks this company has finely prospered and the increase of stock is made necessary by the large increase of the business.

—— Argument on the application made last week by Mrs. Louise M. Yocum and four other property owners adjacent to the St. George Hotel, Brooklyn, for an injunction to restrain the proprietors from using machinery for the manufacture of electricity to light the premises was heard in the Supreme Court, by Judge Bartlett. The petitioners claim that the machinery makes a noise, shakes their buildings and disturbs their rest, and that it is a nuisance generally. This the hotel proprietors deny, and they submitted a large number of affidavits of guests and others in support of the denial. Decision was reserved.

—— At the City and Guilds of London Institute, Exhibition Road, South Kensington, Prof. Ayrton is about to give a series of demonstrations in the testing of the power and efficiency of electro-dynamos and motors; the modes of measuring self-induction, and the use of commercial apparatus for the purpose; the determination of the effect of self-induction on intermittent direct currents with long and short periods of intermittency, and on alternate currents with different periods of alternation. Each demonstration will take place twice, to enable all who attend to take part. There will be seven demonstrations, commencing Friday, February 4, at 5 P.M., and ending Wednesday, March 23.

ELECTRIC LIGHT NEWS

—— The City Council of Seneca, N. Y., has contracted with the Brush Electric Light Company for twenty-seven additional street lights.

—— Electric light has recently been introduced at the woolen mill of the Mineral Springs Manufacturing Company, at Stafford Springs, Conn.

—— The Addison Electric Light Company, Addison, N. Y., has been formed. The Brush-Swan system is to be used. New central station and 300 lights have been contracted for.

—— The East Liverpool (Ohio) Western Electric Company has been incorporated with a capital stock of $16,000; also the Western Electric Light and Power Company, of Toledo, Ohio, with a capital of $20,000.

—— The electric lights went out on Main street, Springfield, Mass., recently, and for five minutes, while a slight trouble was being remedied, the darkness was intense. That's one way to learn how to appreciate the electric lights.

—— A Los Angeles (Cal.) exchange speaks very highly of a new electric light globe invented by Col. Howland, of that city. The globes shed a very agreeable and soothing light over everything within their radius, though every object is well defined and discernible.

—— In Union there is strength, appears to have been adopted by the various French Edison companies who recently held a general assembly, having for its object a grand union of the Edison Continental Company, the Electrical Society and the Industrial and Commercial Edison Company.

—— There are two electric light companies in Newark, N. J., one using wooden poles and the other iron, the latter in accordance with instructions from the public lighting committee. The matter was recently argued, and the committee decided to let the companies use either kind of poles.

—— At Antwerp, in the workshops of the lapidaries, the electric light enables the workmen to pursue their labors more hours per day in winter than without it. Gas light does not fill the bill, the flickering being fatiguing to the eyes. It is not unlikely, too, that a more ready distinction of colors is the result of electric lighting, which would be an additional relief to the eyes.

—— The Staten Island Rapid Transit Railroad Company have awarded the contract for building the three steel ferryboats to Harlan & Hollingsworth, of Wilmington, Del. The boats will be 236 feet in length, the same breadth of beam as the Southfield, with 7 feet draft when loaded, and will cost about $100,000 each. They will be lighted with electricity. The first boat will arrive about June 15.

—— Mr. M. J. Hart, of New Orleans, representing the Louisiana Electric Light Company, has introduced an ordinance asking for permission to erect towers for the purpose of carrying telegraph, telephone and electric light wires. The plan is to have slender iron poles rise up from the street corners, form a sort of arch overhead, and sustain a pole with cross-pieces, each division of cross-pieces being for a different sort of wire. No wire is to be lower than ten feet above the tops of the buildings. Mr. Hart claims that this plan will be ornamental and convenient, and do away with the poles. He says he has invited the various companies interested to co-operate in forming a company. The bonus to the city has not yet been fixed, but the ordinance proposes a percentage of the receipts. Mr. Hart is now in St. Louis, and will interview Col. Fladd, the orignator of the tower system.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JAN. 18, 1887.

355,867 Electrical subway; Russel A. Denison, Providence, R. I.

355,871 Electric meter; James E. H. Gordon, Kensington, county of Middlesex, England.

355,892 Electro-magnetic regulator for valves; Geo. M. Sternberg, U. S. Army.

355,893, 355,894 and 355,895 Electro-magnetic regulator for dampers and valves; Geo. M. Sternberg, U. S. Army.

355,928 and 355,929 Telephone switch system; Claude C. Gould, Buffalo, and Walton Smith, Batavia, assignors o one-fourth to Philip W. Scribner, Tonawanda, N. Y.

355,952 Telephone transmitter; John C. H. Stut, San Francisco, Cal.

356,008 Electric cut-out; Arthur E. Paige, Philadelphia, Pa.

356,019 Incandescent electric lamp; William S. Voelker, Morton, Pa., assignor to John H. Irwin, trustee, same place.

356,024 Controlling valves by electricity; Foree Baln, Chicago, Ill.

356,034 Telephone transmitter; James P. Freeman, Chicago, Ill., assignor of one-half to Samuel M. Bryan, Washington, D. C.

356,038 Grounding switch for telephone instruments; Claude C. Gould, Batavia, N. Y., assignor of five-eighths to Walton Smith, same place, and Philip W. Scribner, Tonawanda, N. Y.

356,040 Telephone switch; Charles A. Hitchcock and William Bromley, North East, assignor to themselves and Lewis F. Watson, Warren, and Samuel A. Davenport, Erie, Pa.

356,041 and 356,042 Electric current indicator; John W. Howell, New Brunswick, N. J.

356,069 Primary electric clock; Vitalis Himmer, New York, N. Y., assignor to the Standard Electric Clock Company, same place.

356,070 Watchman's time recorder; Vitalis Himmer, New York, N. Y., assignor to the Standard Electric Clock Company, same place.

356,151 and 356,152 Underground conduit for electric conductors; James F. Munsle, Chicago, Ill.

356,153 Electric wire or cable-distributing system; James F. Munsle, Chicago, Ill.

356,156 Insulating telegraph cables; William R. Patterson, Chicago, Ill., assignor to the Western Electric Company, same place.

356,197 Telephone receiver; Ezra T. Gilliland, New York, N. Y.

356,199 Incandescent electric lamp; William Holtzer, Harrison, N. J.

356,206 Manufacture of telegraph cables; Wm. R. Patterson, Chicago, Ill., assignor to the Western Electric Company, same place.

HEADQUARTERS MICA ALL SIZES and QUALITIES.
For ELECTRICAL PURPOSES.
EUGENE MUNSELL & CO.,
218 Water Street, New York.

BUSINESS NOTICE.

"In making the statements which follow we can verify each and all of them as facts. Mr. Edward P. Thompson, of Temple Court (7 Beekman St.,) New York, is a good man to bring your patent cases to, for he is thoroughly versed in all the ins and outs of a Patent Attorney's duties. The following are some of his qualifications: Graduate of Stevens Institute as Mechanical Engineer. For four years tutor of classes of young men in mathematics and experimental physics at Elizabeth, N. J. Served professionally as Electrician and Chemist in the Swan Electric Company of New York for two years. Because of past successes as a Patent Attorney at 13 Park Row, New York, was appointed, to succeed N.S. Keith, of the patent agency of the *Electrical World* and Associate Editor, N. S. Keith is known as the Translator and Reviser of Schellen's Treatise on "Dynamo Electric Machinery." Mr. Thompson for two years personally prepared and prosecuted all the patent business of *Electrical World's* Patent Agency, and is the author of a series of articles in said paper upon "Analytical and Systematic Method of Inventing," which were widely known and favorably received. Mr. Thompson is a member of American Institute of Electrical Engineers and American Society of Mechanical Engineers. He is author of the "Expansion of Polynomials," which the ablest mathematicians of the world universally commend." —*New York Observer.*

THE ANNUAL MEETING
—OF—
The National Electric Light Assoc'n.
WILL BE HELD IN PHILADELPHIA,
—AT THE—
HOTEL LAFAYETTE,
—ON—
TUESDAY, FEBRUARY 15, '87
AT 12 O'CLOCK M.

The Executive Committee will meet at the same place on Monday the 14th, at 3 P. M.

Members requiring Hotel Accommodations will please address,

A. J. DE CAMP,
Chairman Executive Com.,
Stating what is required.

ROYCE & MAREAN,
DEALERS IN
ELECTRICAL APPARATUS
Telegraph and Telephone Supplies,
No. 1408 Penna. Avenue,
Opp. Willard's Hotel, WASHINGTON, D. C.

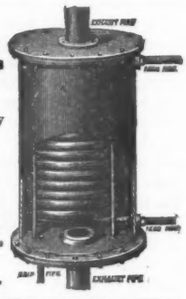
CARBONS
FOR ARC LIGHTING.
Only Manufacturers using Natural Gas, thus securing
Uniformity, Durability & Superior Light.
PITTSBURGH CARBON CO. lim'd,
PITTSBURGH, PA.

UNITED ELECTRIC COMPANY,
SALT LAKE CITY, UTAH, AND CHEYENNE, WYO.,
Dealers in Electrical Apparatus and Supplies.
We have special facilities for furnishing material and doing work in Utah, Wyoming, Idaho, Montana and Washington Territories at Eastern prices.
UNITED ELECTRIC COMPANY,
Post Office Box 277, SALT LAKE CITY, UTAH. | Post Office Box 574, CHEYENNE, WYOMING

KANSAS ELECTRIC CO.
185 Kansas Ave., Topeka, Kansas.
DEALERS IN
Hotel Annunciators, Burglar Alarms, Fire Alarms, Telegraph Poles, Electric Bells, Electric Gas Lighting and Electric Alarm Matting.
ESTIMATES GIVEN ON ELECTRIC LIGHT PLANTS, Fire Alarm Systems and Private Telephone Lines.

Detroit Electrical Works
MANUFACTURERS OF
ELECTRIC SUPPLIES,
INCLUDING
Medical Batteries, Skeleton and Box Bells, Burglar Alarms, House Annunciators, Fire Alarm Boxes, Pins, and Brackets,
INSULATED MAGNET, TELEPHONE AND ELECTRIC LIGHT WIRE.
GENERAL OFFICES and FACTORY:
DETROIT, MICHIGAN.

THE
National Feed Water Heater.
A BRASS COIL HEATER,
Supplying feed water to the boiler at 206° to 212° F. A reliable and very effective heater. Over 1,500 in use in the United States.
150 Electric Light Stations Supplied, and Orders being filled every week.
Seventeen sizes manufactured, from 8 to 2,000 H.P.
PRICES LOW AND SATISFACTION UNIVERSAL.
THE NATIONAL PIPE BENDING CO
84 River Street, New Haven, Conn,
Coils and Bends of Brass and Copper Pipe Made to Order.



PHOENIX GLASS COMPANY,
(Works, Water Cure, Beaver County, Penn.)

Fig.259

Fig.255

—MANUFACTURERS OF—
A FULL LINE OF ELECTRIC LIGHT GLOBES & SHADES, BOTH ARC AND INCANDESCENT,
In Opal, Flint and Art Glass Effects, in Opalescent and other Colors,
A. H. PATTERSON, Manager. 729 BROADWAY, COR. WAVERLEY PLACE, NEW YORK.

THE ONLY GENUINE
LECLANCHÉ DISQUE BATTERY
IS THAT MADE BY
THE LECLANCHÉ BATTERY COMPANY.
Every Jar and Porous Cell bears the label and trade mark as shown in the cut.
All others are imitations.
DO NOT BE IMPOSED UPON.
IF DEALERS HAVE NOT THE GENUINE BATTERY. SEND DIRECT TO US FOR PRICE LIST.
None of the Imitations Compare with it in Efficiency.
THE LECLANCHÉ BATTERY CO.
149 W. 18th St., New York.

GENUINE DISQUE CELL, COMPLETE.
The Porous Cell also bears Label.

GENUINE DISQUE POROUS CELL.

Standard ✣ Electrical ✣ Works,
MANUFACTURERS OF
TELEGRAPH AND TELEPHONE APPARATUS,
Hotel and House Annunciators, Burglar Alarms,
CALL BELLS, "POST'S" MAGNETO BELLS,
PINS and BRACKETS, BATTERIES, &c., &c.
IN STOCK:—FULL LINE
IRON, STEEL and HARD-DRAWN COPPER WIRE, Delivered at Lowest Prices.
☞ ESTIMATES FURNISHED. SEND FOR CATALOGUES AND PRICES. ☜
Cincinnati, Ohio, U. S. A.

E. P. GLEASON MANFG. CO.

Manufacturers of every description of Etched, Cut, Sand-blast, Flint, Opal and Colored

GLOBES and SHADES for ELECTRIC LIGHTING.

BRASS WORK TO ORDER.

SEND FOR CUTS AND PRICES.

181 to 189 Mercer Street, New York.

THE CLEVERLY ELECTRICAL WORKS,

1018 Chestnut Street, Philadelphia.

ELECTRICAL SUPPLY MAKERS.

UNION FIRE ALARM CO.

145 BROADWAY, NEW YORK,

ARE NOW PREPARED TO FURNISH THE CHEAPEST, BEST AND MOST COMPLETE

FIRE ALARM SYSTEM

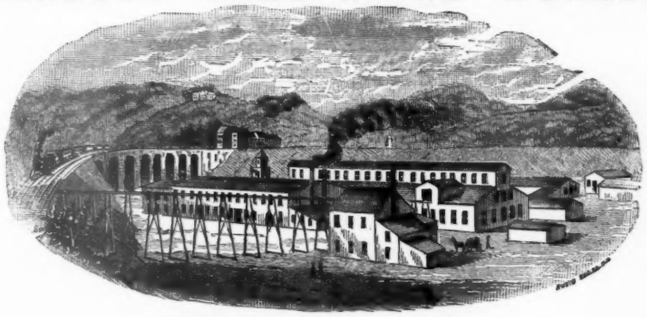
EVER DEVISED.

PARTICULARLY ADAPTED TO SMALL CITIES AND TOWNS.

WE DEFY COMPETITION.

Correspondence Solicited and Estimates Furnished.

VIADUCT ELECTRICAL WORKS,



at RELAY STATION, B. & O. R. R.

Office, N. W. Cor. Charles and German Sts., Baltimore, M. D. A. C. DAVIS, President.

PURCHASE ELECTRICAL GOODS DIRECT FROM MANUFACTURERS, AND SAVE ALL DISCOUNTS, COMMISSIONS, ETC.

USE MAGNETO SIGNAL BELLS. (No battery.) Protect your house with BURGLAR ALARMS, light your gas with ELECTRIC BURNERS, safer, cleaner and cheaper than matches.

HOTELS—Use our GUEST CALL, to awaken and call guests by sounding a bell in each room; invaluable at all times, but especially so in case of fire.

FACTORIES, STORES—Summon foreman, porter, janitor or other employees on different floors with our MAGNETO BELL. Always in order.

NOTE—Send for Catalogue and mention this Paper.

THE

ELECTRICAL ACCUMULATOR CO.,

MANUFACTURERS OF

STORAGE BATTERIES

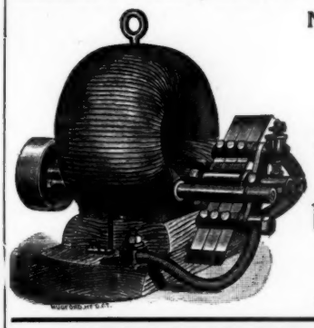
OFFICE: 44 BROADWAY, NEW YORK.

Factory: NEWARK, N. J.

The Mather Dynamo-Electric Machine,

FOR

ELECTRO-PLATING, ELECTROTYPING, COPPER REFINING, ETC.



NO REVERSING,
NO WATER,
NO NOISE,
NO SPARK.

SATISFACTION GUARANTEED.

Manufactured by

The Eddy Electric Mfg. Co.

42 UNION PLACE, Opposite the Station,

HARTFORD, CONN.

☞SEND FOR CIRCULAR.

EUGENE F. PHILLIPS, PRESIDENT. W. H. SAWYER, SEC'Y & ELECTRICIAN.

American Electrical Works,

PROVIDENCE, R. I.

EXCLUSIVE MANUFACTURERS OF THE

FARADAY CABLE

FOR TELEGRAPH, TELEPHONE & ELECTRIC LIGHT.

HIGHEST INSULATION AND LOWEST INDUCTIVE CAPACITY OF ANY CABLE IN THE MARKET.

NEW YORK OFFICE
15 Cortlandt Street

HARRY HALL, Agent.

BUSINESS NOTICE.

NEW BANKING FIRM.—We have formed a co-partnership to transact a banking and brokerage business under the firm-name of CLEVELAND, WHITNEY & Co., at No. 7 Exchange place, opposite Stock Exchange, Boston. Will buy and sell on commission, for cash or on margin. Stocks and bonds at all the exchanges. We shall give special attention to investment securities and the negotiation of loans. Correspondence solicited. Private wires.

H. M. CLEVELAND.
R. H. WHITNEY.

Boston, Jan. 1, 1887.

H. G. CHENEY, President. P. H. WOODWARD, Secretary and Treasurer. ROBERT CHENEY, Vice-President.
N. T. PULSIFER, General Manager. R. H. MATHER, Con. Electrician.

THE MATHER ELECTRIC CO.

HARTFORD, CONN.,

Sole Manufacturers under all the Patents of Richard H. Mather for

Electric Lighting and Transmission of Power.

Also Sole Manufacturers under all the Patents of Charles G. Perkins for

Incandescent Lamps and Appliances for Incandescent Lighting.

EXECUTIVE OFFICE, HARTFORD, CONN.

New York Office, 145 Broadway. Cincinnati Office, Carlisle Building.
Chicago Office, 117 and 119 Lake St. Atlanta Office, 16 North Broad Street.

PROTECTION FOR WATCHES.

—The Anti-Magnetic Shield is an absolute protection from all Electric and Magnetic Influence. Can be applied to any watch. Full Experimental Exhibition and Examination, also full assortment of the watches complete at

F. S. GILES, Agent, or GILES, BRO. & CO., Chicago, Ill.

ANTI-MAGNETIC SHIELD & WATCH CASE CO., 18 John St., New York.

W. C. Masters, President. W. H. Lawrence, Manager.

THE NATIONAL CARBON CO.

CLEVELAND, OHIO.

MAKERS OF ELECTRIC LIGHT CARBONS AND BATTERY MATERIAL.

—THE—

SOLAR CARBON & MFG. CO.

(Works near Pittsburgh, Pa.)

Electric Light men know the trouble arising from impurities in Carbons. This Company obtains its supply of Carbon from NATURAL GAS, and such gas is used throughout the process. Hence they claim to sell a CHEMICALLY PURE Carbon, unequaled in brilliancy and life.

Selling Agents:

VITRITE & LUMINOID CO., 14 Dey St. New York.

S. B. RICHARDS, M'g'r, General Eastern Office, 55 S. 3d St., Philadelphia.

A PERFECT ELECTRIC LIGHT GLOBE.

THE UNION GLASS COMPANY,

BOSTON, MASS., U. S. A.,

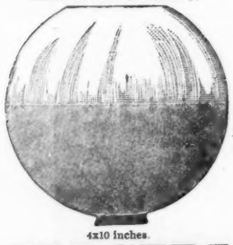
MANUFACTURERS OF EVERY DESCRIPTION OF

ARC AND INCANDESCENT

ELECTRIC-LIGHT GLOBES

SEND FOR PRICE-LIST.

HALF GROUND (Horizontally).



4x10 inches.

THE

LITTLE--McDONALD CUT--OUT.

PATENTED MAY 20, 1886. 1,000 IN USE.

SEND FOR CIRCULARS AND PRICES

J. A. POWERS,

TROY, NEW YORK.

THE ELECTRICAL SUPPLY CO.

Manufacturers of and Dealers in

ELECTRICAL INSTRUMENTS and SUPPLIES.

Being Manufacturers of Bare and Insulated Wires and Cables of every description, we are prepared to give prices for large quantities.

We Manufacture the Celebrated Wallace Diamond Carbons for Electric Lights, which are Superior to all others.

OUR NEW ILLUSTRATED CATALOGUE WILL BE MAILED TO ANY ADDRESS FREE OF CHARGE.

THE ELECTRICAL SUPPLY CO.

171 Randolph Street, Chicago, and 17 Dey Street, New York.

LOWEST PRICES FOR

BELLS,

HAZAZER & STANLEY,

32 FRANKFORT ST., New York.

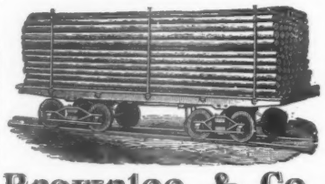
STANDARD

Electrical Test Instruments.

Galvanometers, Resistance Coils, Condensers, Keys, Switches, &c., Bailey Combination Set, Pratt's Speed Indicator, &c.

Electric Mfg. Co., Troy, N. Y.

OFFICE, 311 RIVER STREET.



Brownlee & Co.,

DETROIT, MICH.

DEALERS IN

Cedar Telegraph Poles

MANUFACTURERS OF

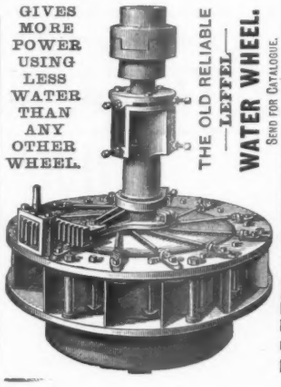
Cross Arms, Pins and Brackets,

OAK AND LOCUST PINS,

BROWNLEE'S CONCAVED BRACKET.

Patent applied for.) Send for Catalogue

GIVES MORE POWER USING LESS WATER THAN ANY OTHER WHEEL.



THE OLD RELIABLE —LEFFEL— WATER WHEEL.

SEND FOR CATALOGUE.

JAMES LEFFEL & CO.

SPRINGFIELD, O., OR 110 LIBERTY ST., N. Y.

ALFRED F. MOORE,

Manufacturer of

Insulated Wire,

for Telephone, Telegraph and Electric Light.

OFFICE, LINE, AND

Annunciator Wire,

Magnet Wire, and Flexible Cordage,

200 & 202 N. THIRD ST.

PHILADELPHIA, PA.

CARBONS

BOULTON CARBON CO.

FORMERLY

Boulton Standard Carbon Comp'y,

CLEVELAND, OHIO.

We do not brag about our Carbons, but we challenge the World to produce a better.

D. W. Baker. C. O. Baker, Jr.

BAKER & CO.,

Importers, Melters and Refiners of

PLATINUM,

408, 410, 412 and 414 N. J. R.R. Ave., NEWARK, N. J.

Platinum in sheet and wire, all sizes, and any degree of hardness. Scrap and native platinum purchased.

JOHNSON HEAT-REGULATING APPARATUS.

Can be attached to any kind of heating apparatus ever made, and by its use the heating of buildings to a uniform temperature is accomplished. Rooms may be kept at any temperature desired, thereby saving fuel, discomfort, ill health, the cracking of wood-work, furniture and pictures, and the danger of fire by over heating. This apparatus applies equally well to all forms of heating and ventilating devices, the thermometer in the room automatically governing the temperature. It is invaluable in Public Buildings, Private Residences, Business offices, Hospitals, Churches, Schools, Conservatories, Factories, etc.

SEND FOR CIRCULAR "R."

NATIONAL ELECTRIC SERVICE CO.

NEW YORK, 686 Broadway. CHICAGO, 195 Wabash Avenue. BOSTON, 611 Washington Street.

Poole & Hunt's Leffel Turbine Water Wheel.

Made of Best Materials and in the Best Style of Workmanship.

MACHINE-MOLDED MILL GEARING,

From 1 to 20 feet diameter, of any desired face or pitch, molded by our own special machinery.

SHAFTING, PULLEYS AND HANGERS

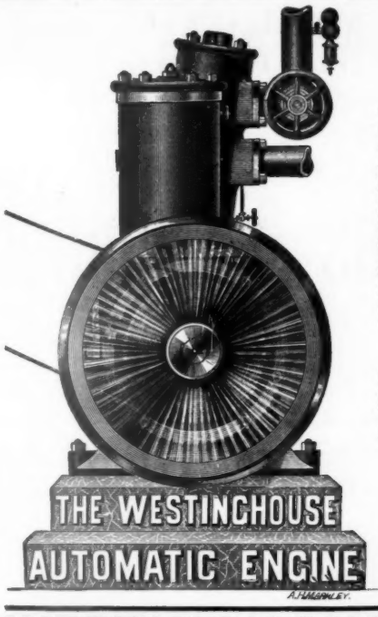
Of the latest and most improved designs.

Transmission Machinery

A SPECIALTY.

☞ Special attention given to Heavy Gearing. Shipping facilities the best in all directions.

POOLE & HUNT, Baltimore, Md.



THE WESTINGHOUSE MACHINE CO.

SALES LIST FOR NOVEMBER. 1886.

			H. P.
South Side E. L. Co.,		Pittsburgh, Pa.	150
" "	2d order,	" "	150
Union Switch & Signal Co.,	6th order,	" "	75
East End E. L. Co.,	2d order,	" "	75
" "	3d order,	" "	75
Brush Electric Light Co.,	2d order,	Buffalo, N. Y.	60
McConway & Torley,	2d order,	Pittsburgh, Pa.	60
Winona Paper Co.,	4th order,	Holyoke, Mass.	60
New York & Manhattan R. R. Co.,		New York.	60
Mather Electric Co.,		Hartford, Ct.	60
" "	2d order,	" "	60
Jefferson City E. L. Co.,		Jefferson City, Mo.	60
Wahoo E. L. Co.,		Wahoo, Neb.	60
J. C. Livingston & Co.,		Little Falls, N. Y.	45
Weidman Silk Dyeing Co.,		Paterson, N. J.	45
Miller, Broudy & Co.,		Alexandria, La.	45
E. L. McLain Mfg. Co	2d order,	Greenfield, O.	45
Van Deventer & Hoone,		Plainfield, N. J.,	35
"The Public Ledger,"	2d order,	Philadelphia, Pa.	35
" "	3d order,	" "	35
" "	4th order,	" "	35
" "	5th order,	" "	35
E. Balbach & Son,	14th order,	" "	35
Wolff & Hamaker,		Chambersburg, Pa.	35
Imperial Guano Co.,		Norfolk, Va.	35
Chandler & Price,		Cleveland, O.	35
Wabash, St. L. & Pacific R. R.	2d order,	Ft. Wayne, Ind.	35
Barnes Bros.,		Maquoketa, Ia.	35
A. J. Mullen,		Selma, Ala.	35
Brainard & Shephard,		Albany, N. Y.	35
Henry Warden,		Philadelphia, Pa.	35
Crown Mills,		Marcellus, N. Y.	35
S. R. Cain,		Bristol, Vt.	25
Wabash, St. L. & Pacific R. R.	3d order,	Ft. Wayne, Ind.	25
Minneapolis Gas Light Co.,		Minneapolis, Minn.	25
" "	2d order,	"	25
Thos. Henshall,		Paterson, N. J.	15
E. Balbach & Son,	15th order,	Newark, N. J.	15
Gas Engine and Power Co.,		New York.	15
Roulleaux, Dugage & Co.,	2d order,	Suresnes, Fr.	15
Shickle, Harrison & Howard	2d order,	St. Louis, Mo.	15
McCord, Ford & Co.,		Colfax, W. T.	15
Decatur Furnace Co.,		Decatur, Ala.	15
Lawrence Machine Shop,	15th order,	Lawrence, Mass.	10
" "	16th order,	" "	10
N. W. Wait, Son & Co.,		Sandy Hill, N. Y.	10
F. S. Cole,		Grundy City, Ia.	10
Union Pacific R. R.,	2d order,	Omaha, Neb.	10
Geo. C. Howard,		Philadelphia, Pa.	5
Merritt W. Burwell,		New Haven, Ct.	5
Westinghouse Electric Co.,	3d order,	Pittsburgh, Pa.	5
Lawrence Machine Shop,	17th order,	Lawrence, Mass.	5
" "	18th order,	" "	5
J. A. Diamond,		Indianoplis, Ind.	5
F. J. Yandle,		Santa Rosa, Cal.	5
Aberdeen Packing Co.,		Astoria, Or,	5
TOTAL, 56 ENGINES,			1975

Sales Department for the U. S. Conducted by

WESTINGHOUSE, CHURCH, KERR & CO., 17 Cortlandt St., N. Y.; 98 Fourth Ave., Pittsburgh, Pa.
FAIRBANKS, MORSE & CO., Chicago, Ill.
FAIRBANKS & CO., St. Louis, Mo.
PARKE & LACY, San Francisco, Cal.
PARKE, LACY & CO., Salt Lake, Utah.
D. A. TOMPKINS & CO., Charlotte, N. C.
ROBERT MIDDLETON, Mobile, Ala.
H. DUDLEY COLEMAN, New Orleans, La.
KEATING IMPLEMENT & MACHINE CO., Dallas, Texas.

WESTINGHOUSE, CHURCH, KERR & CO.

17 CORTLANDT ST., NEW YORK. 98 FOURTH AVENUE, PITTSBURGH, PA.

Engineers and Contractors for Central Stations for Incandescent Lighting on the

WESTINGHOUSE ELECTRIC COMPANY'S SYSTEM.

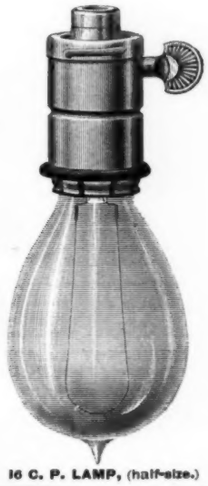
Isolated Incandescent Plants.
Steam Power Plants for Manufacturers.
Direct-connected Centrifugal Pumping Machinery.
Designers of Special Applications of Steam Power.

THE WESTINGHOUSE ELECTRIC COMPANY,

MANUFACTURERS OF ISOLATED INCANDESCENT PLANTS, AND CONTRACTORS FOR CENTRAL STATIONS.

It is believed that the advantages of our system place us beyond competition.
Capital investing for dividends will do well to close no contracts till our proposals are considered.

The Westinghouse Electric Company, - - - Pittsburgh, Pa.



16 C. P. LAMP, (half-size.)

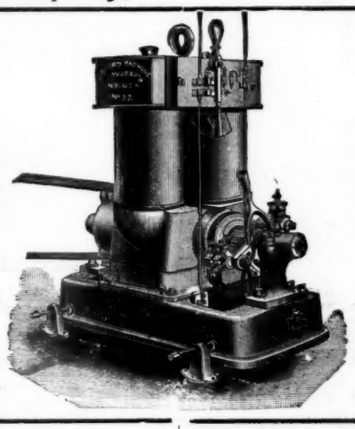
EDISON LIGHT.

The Edison United

65 FIFTH AVE.

Estimates Furnished

For use in Mills, Hotels,



EDISON LIGHT.

Mfg. Company,

NEW YORK.

For Isolated Plants,

Theatres, Steamboats, etc.

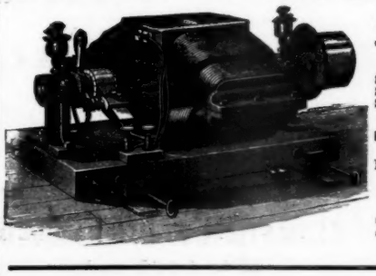
THE American Bell Telephone Company,

95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30, 1877, No. 186,787.

The Transmission of Speech by all known forms of ELECTRIC SPEAKING TELEPHONES infringes the right secured to this Company by the above patents, and renders each individual user of telephones, not furnished by it or its licensees, responsible for such unlawful use, and all the consequences thereof and liable to suit therefor.

HECLA ELECTRIC LIGHT COMPANY,



MANUFACTURERS OF THE

Jackson Dynamo-Electric Machines, Lamps, Etc.

For Arc and Incandescent Lighting.

Size A, capacity 20 16 c. p. lamps **Price, $160**
Size B, capacity 30 16 c. p. lamps. **Price, $260**
Size C, capacity 50 16 c. p. lamps. **Price, $340**

—ALSO—

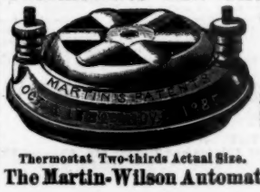
ELECTRICAL SUPPLIES OF ALL KINDS ALWAYS IN STOCK.

Estimates for complete Electric Light and Steam Plants made on application. Send for Circular, and mention this paper.

OFFICE:

26½ E. 42d St., New York.

Thermostats and Thermostatic Fire-Alarm Apparatus.



Thermostat Two-thirds Actual Size.

OUR PATENT CLOSED-CIRCUIT SYSTEM IS ABSOLUTELY RELIABLE AND ECONOMICAL, AND DOES NOT GIVE A FALSE ALARM WHEN THE CIRCUIT IS BROKEN ACCIDENTALLY.

Our patent hydro-carbon thermostat is ornamental, adjustable and never ailing, closing or opening the circuit with great force, and does not destroy itself by use. A sample thermostat mailed on receipt of one dollar.

Territorial rights and licences can now be negotiated.

SEND FOR CIRCULAR TO

The Martin-Wilson Automatic Fire Alarm Co., 53 State St., Boston, Mass.

WESTERN ELECTRIC COMPANY,

CHICAGO—NEW YORK—ANTWERP—LONDON.

Telegraph & Telephone Apparatus & Supplies.

The Best of Everything at Bottom Prices.

Roberts-Brevoort Electric Co.

(LIMITED,)

Manufacturers of

THE ROBERTS PER-OXIDE BATTERY

AND

THE ROBERTS DRY BATTERY.

These batteries have each about 1.8 volts. The Per-O-ide Battery is intended for severe open-circuit work. Our dry Battery is **something entirely new.** It is put up in a sealed cell; **no fluid to spill;** can be used in **any position.**

Liberal trade discount. Send for Price List and Circular to the company's office.

Per-Oxide Battery	**$1.00**
Dry Battery	**$1.50**

206 Broadway, New York.

FOR SALE BY ALL DEALERS.

SCHAEFER ELECTRIC MFG. CO.

INCANDESCENT LAMPS, From 10 to 100 Candle Power. DYNAMO MACHINES of Improved Construction.

Proposals and Estimates furnished for Complete Installations of Incandescent plants upon application to

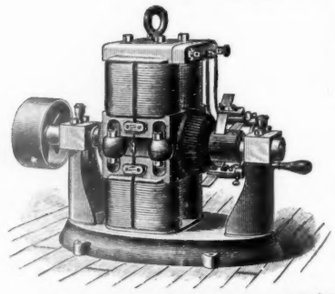
P. O. Box, 3068, Boston, Mass.

FACTORY AT CAMBRIDGEPORT, MASS.

ALL of the ACTUAL

—AND—

PRETENDED



Advantages in Arc Lighting Announced in Chorus by our lively Competitors are

DEMONSTRATED BEYOND QUESTION

—IN THE—

WATERHOUSE SYSTEM.

Great Saving of Power,
Instantaneous Automatic Regulation,
Noiseless, Steady Lights,
The Only System in the World,
Right hand of fellowship to the Gas Interests,
Etc., Etc., Etc.

THE WATERHOUSE ELECTRIC AND MFG. COMPANY,

Factory, Colt's West Armory. HARTFORD, CONN.

FRANKLIN S. CARTER. CHAS. M. WILKINS. E. WARD WILKINS.

ESTABLISHED 1867.

PARTRICK & CARTER,

Manufacturers of and Dealers in every description of

ELECTRICAL SUPPLIES for the TELEGRAPH, TELEPHONE, ELECTRIC LIGHT, ETC.

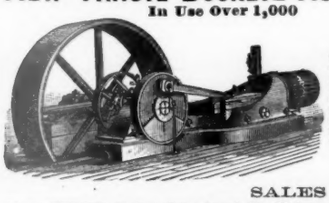
Sole proprietors of the Patent Needle Annunciator. Annunciators, Burglar Alarms, Electric Bells, Batteries, Wire, etc. Illustrated catalogues and price lists sent free.

No. 114 SOUTH SECOND STREET, - - PHILADELPHIA, PA.

NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

In Use Over 1,000

25 to 1,000 H. P.



These Engines are the combined result of long experience with automatic cut-off regulation and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-Contained Automatic Cut-off Engines, 12 to 100 H.P. for driving Dynamo Machines a SPECIALTY.—Illustrated Circulars with various data as to practical Steam Engine Construction and performance, free by mail. Address

BUCKEYE ENGINE CO., Salem, O.

SALES AGENTS:

W. L. SIMPSON, Eastern Sales Agent, No. 70 Astor House, New York.
N. W. ROBINSON, cor. Clinton and Jackson Sts., Chicago, Ill.
ROBINSON & CAREY, St. Paul, Minn. and PRAY MANUFACTURING CO., Minneapolis, Minn.

Schuyler Electric Light Co.,

Manufacturers of

DYNAMO MACHINES FOR INCANDESCENT AND ARC.

The most perfect system of both Incandescent and Arc Lighting. Entire freedom from hissing and flickering in our Arc Lights, and long life and great brilliancy in our Incandescent Lights.

Dynamo Machines with perfect automatic regulation, reliable and efficient. Prices moderate. Estimates made for lighting from Central Stations or for isolated plants. Illustrated Circulars sent upon application. Address

New York Office: SCHUYLER ELECTRIC LIGHT CO.,
No. 44 BROADWAY. Hartford, Conn.

MITCHELL, VANCE & CO.,

GAS FIXTURE MANUFACTURERS,

Have added a department for the Manufacture of Electroliers and other fixtures adaptable to any system of Incandescent Electric Lighting, also Combination Fixtures for both Gas and Electric Light. Estimates and designs furnished upon application.

836 & 838 BROADWAY.
NEW YORK

THE

AMERICAN ELECTRICAL DIRECTORY,

Handsomely Bound and Finished in Cloth, Containing 500 pages devoted to the

INTERESTS OF ELECTRIC LIGHTING.

A Complete List of All and a Report of

Each Electric Light Co. in North America

A Handy Book for Reference.

—PRICE, $2.00—

Published by the

STAR IRON TOWER CO.,

Fort Wayne, Ind., U. S. A.

Connecticut Electric Co.

101 BANK STREET,

WATERBURY, CONN.

Zincs, Leclanche Zincs,

with Thumb Screw or Patent Spring Connections, and well amalgamated

GRAVITY BATTERY ZINCS,
MEDICAL BATTERY ZINCS,
BUNSEN BATTERY ZINCS,
ZINC PLATES,

MADE FROM PURE SPELTER.

WOOD AND BRONZE PUSH BUTTONS,
BURGLAR ALARM SPRINGS.

SHEPARD'S $60. CELEBRATED

Screw-Cutting Foot Lathe.

CAP LATHE, $125.

Foot and Power Lathes, Drill Presses, Scrolls, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, &c. Send for catalogue of outfits for amateurs or artisans. Address,

H. L. SHEPARD, Agt.,

134 E. SECOND STREET, CINCINNATI, O.

OUR NEW

LECLANCHE FARADIC MEDICAL BATTERY

Our Leclanche Faradic Medical Battery is of a new and entirely original design.

It is a new departure, and avoids the use of all obnoxious acids that destroy the clothes, stain the hands and make the constant handling of such medical batteries absolutely dangerous.

It is simplicity itself, and in ordinary use will run ONE YEAR WITHOUT ANY ATTENTION, OR THE EXPENDITURE OF A SINGLE PENNY FOR SUPPLIES.

There is no zinc to raise or lower, no fluids to be renewed. It is always ready, and does not corrode when not in use. Its first cost and the subsequent expense is far less than that of the dangerous red or white acid batteries heretofore manufactured.

The LECLANCHE FARADIC has three currents, is nickel-plated and mounted in an ornamentally covered case, 8¼x6¾x5¼ inches in size, and sold at the low price of **$8.50.**

E. S. GREELEY & CO.

(Successors to L. G. TILLOTSON & CO.,)

Manufacturers, Importers and Dealers in

TELEGRAPH, TELEPHONE AND ELECTRICAL INSTRUMENTS and MATERIAL OF EVERY DESCRIPTION,

Nos. 5 and 7 DEY STREET - - NEW YORK.

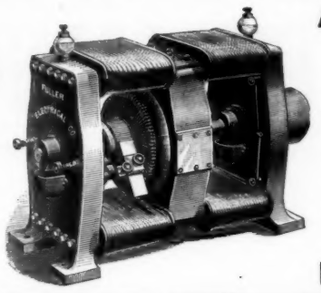
The Fuller-Wood Electric Light Co. (Limited),

228 WEST 23d STREET, NEW YORK.

OFFER FOR SALE

Improved Gramme Dynamos.

For 1 Light	of 6000	Candle Power.	
" 3 Lights	" 2500	"	" each.
" 8 "	" 2000	"	" "
" 10 "	" 2000	"	" "
" 16 "	" 2000	"	" "
" 23 "	" 2000	"	" "
" 50 "	" 2000	"	" "



AT GREATLY REDUCED PRICES,

ARC LAMPS.

Single	6000	Candle Power.	
"	2000	"	"
Duplex	2000	"	"
Focusing	6000	"	"
"	200	"	"

PROJECTORS, HEADLIGHTS, &c

JARVIS ENGINEERING CO.,

BOSTON, MASSACHUSETTS.

CONTRACTORS FOR

Complete Steam Outfits for Electric Lighting Stations, Steel Boilers with Jarvis Furnaces to burn cheap fuels, Armington & Sims Engines, Etc.

SEND FOR CIRCULARS.

SHAW : & : GEARY

MANUFACTURERS OF

ELECTRICAL APPLIANCES

Special Tools and Dies. Model and Experimental Work a specialty.

Nos. 53 and 55 North Seventh Street, Philadelphia.

J. E. JEFFORDS & CO.

Manufacturers to the Trade.

POROUS CELLS

Of Every Description, Made to Order.
25 years' experience in this branch of the business.
2716 to 2738 Salmon St., Philadelphia, Pa.

Wellington Belt Holder

The simplest, cheapest and handiest device in existence for shifting Dynamo Belts. Please write for circulars to

W. R. Santley & Co.
WELLINGTON, O.

There are now in use over 18,000

OTTO GAS ENGINES.

Guaranteed to Consume 25 to 75 Per Cent. Less Gas than ANY OTHER GAS ENGINE Per Brake Horse-power.

Works without boiler, steam, coal, ashes or attendance. Successfully adapted instead of steam power in all industries and offers special advantages for running electrical machinery for Telegraph and Telephone as well as Lighting purposes.

OTTO GAS ENGINE WORKS,
SCHLEICHER, SCHUMM & CO.
N. E. corner 33d & Walnut Sts., Phila.
Branch Office: 130 Washington St., Chicago.

SAWYER-MAN ELECTRIC CO.

Licensed by and Succeeding to the Commercial Business of the

Consolidated Electric Light Company,

—OWNERS OF THE SAWYER-MAN PATENTS.—

GENERAL OFFICES.
Mutual Life Building,
No. 32 NASSAU ST.,
N. Y. City.

PHILADELPHIA OFFICE,
No. 205 Walnut Place.
BOSTON OFFICE,
No. 33 FEDERAL ST.

The DYNAMO of this Company is AUTOMATIC in its regulation, and will Maintain a UNIFORM LIGHT, with ALL or ANY PORTION of the lights in Circuit. Our LAMP will NOT BLACKEN and will MAINTAIN its CANDLE POWER during its Guaranteed Life.

Plans and Estimates Furnished for all kinds of Incandescent Lighting.

ESTIMATES FURNISHED FOR THE THOMSON-HOUSTON SYSTEM OF ARC LIGHTING.

STANDARD UNDERGROUND CABLE COM'Y.

GEO. WESTINGHOUSE, Jr., President. RICHARD A. WARING, Vice-President.
JOHN. H. DALZELL, Treasurer. C. H. JACKSON, Secretary.

DIRECTORS—Geo Westinghouse, Jr., Richard S. Waring, Mark W. Watson, John H. Dalzell, Robert Pitcairn, O. T. Waring and C. H. Jackson.

Manufacturers of

The WARING ANTI-INDUCTION and BUNCHED

Telegraph, Telephone and Electric Light, Underground and Submarine

CABLES,

LEAD COVERED WIRE FOR INSIDE USE, PROOF AGAINST DAMPNESS.

128 Pearl St., N. Y. City, {All Work Guaranteed.} Hamilton Building, 94 5th Ave., Pittsburgh, Pa.

NEW ENGLAND GLASS WORKS,

29 MURRAY ST., NEW YORK. 155 FRANKLIN ST., BOSTON.

10 In.—Roughed all over.

10 In.—Opal.

9 In.—½ Horizontal Roughed.

12 In.—½ Vertical Roughed.

WE MAKE A SPECIALTY

OF

ELECTRIC GLOBES,

OF ALL SHAPES, IN

Clear, Roughed, or Opal Glass.

Our Facilities Enable us to Offer Special Inducements in

QUALITY AND PRICE.

14 In—Clear Flint.

W. L. LIBBEY & SON,

BOSTON, MASS.

SEND FOR PRICES.

ELECTRICAL TEST INSTRUMENTS.

MADE BY THE ELECTRIC MFG. CO. OF TROY, N. Y.

GOODS FROM STOCK IN NEW YORK.

VITRITE AND LUMINOID COMPANY, Agents, 14 DEY ST., N. Y.

VICTOR
Turbine Water Wheel.

The attention of **Electric Companies** is called to this **celebrated water wheel** as particularly adapted to their use, on account of its **remarkably steady motion, high speed** and **great efficiency,** and **large capacity** for its **diameter,** being **double** the **power** of most **wheels** of **same diameter.** It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent. of useful effect, **guaranteed.**

SEND FOR CATALOGUE AND PARTICULARS.

STILWELL & BIERCE MFG. CO.,

DAYTON, OHIO.

(Please Mention this Paper.)

A GREAT COMBINATION OF GAS AND ELECTRIC LIGHT INTERESTS.

THE AMERICAN SYSTEM THE PIONEER OF THE NEW DEPARTURE.

ELECTRIC LIGHTING AS DEMONSTRATED BY THE

AMERICAN ELECTRIC MANUFACTURING CO.

EXECUTIVE OFFICES:

MUTUAL LIFE BUILDING, 146 BROADWAY, NEW YORK, U. S. A.

OFFICERS:

EDWARDS H. GOFF, President and General Manager; L. M. BATES, Vice-President; H. E. IRVINE, Secretary and Treasurer; JAMES J. WOOD, Electrician.

GENERAL AGENCIES:

American Electric Construction Company, 146 Broadway, New York—New York State.
St. Paul Gas Co., St. Paul, Minn.—State of Minnesota.
Citizens' Gas Light Co., Jacksonville, Fla.—State of Florida.
Sowdon, Elder & Wright, 131 Devonshire St., Boston.—New England States (except Connecticut.)
Pittsburgh Electric Company, Eugene Ingold, General Manager, 213 Wood St., Pittsburgh, Pa.—Western Pennsylvania, Ohio, Kentucky and West Virginia.
J. M. Chipman, 19 North Pennsylvania St., Indianapolis, Ind.—State of Indiana.
Markle Engineering Company, Detroit, Mich.—State of Michigan.

This company has challenged all other systems to a competitive test of merit without response.

For completeness and simplicity of construction, durability and economy in operation, steadiness and quality of light produced, and perfection in automatic regulation, **THE AMERICAN SYSTEM HAS NO EQUAL.**

The Wood Automatic Regulator is entirely original, absolutely perfect in operation, and is the only perfect automatic current regulator ever invented, the pretensions of rival companies to the contrary notwithstanding.

It still invites comparison, and stands ready to meet any known system of Electric Arc Lighting in open fair competitive tests, upon all points of superiority claimed for its apparatus whenever and wherever a sale is guaranteed to the winner.

POINTS OF EXCELLENCE.

The Wood Automatic Regulator is the only known invention that is perfect in its action for regulating the lamps better on long and short circuits.
It saves oil and commutator brushes.
The American system needs less care, and is run at much less expense than any other system.
Its apparatus occupies less space, weighs less, and requires less motive power for carrying any given number of lights than any other.
Its lights are steadier, and it requires less skill than any other to operate its apparatus.
The American system guarantees absolute safety of armatures from burning. This no other company can do, and it is this burning out of armatures in other systems that makes maintenance so expensive.
The American company stands pledged to make good all their claims to any one desiring an Electric Plant of any kind

ITS ALLIANCE WITH THE GAS COMPANIES. A new element of enormous power is now coming into the company's concerns. The gas interests of the country have been converted to the commercial value of electric lighting as a business enterprise, the particular value of the system owned by this company, and its strong business alliance with the gas property of this company, is worthy of serious consideration of all purchasers of Electric Light Apparatus. Address all communications to

AMERICAN ELECTRIC MANUFACTURING COMPANY,

MUTUAL LIFE BUILDING, 146 BROADWAY, NEW YORK.

THE THOMSON-HOUSTON ELECTRIC CO.

PRINCIPAL OFFICE,

178 DEVONSHIRE STREET, BOSTON, MASS.,

Furnishes the only Perfect

Automatic, Self-Regulating System of Electric Arc-Lighting in the World

In all desirable qualities of ELECTRIC ARC-LIGHTS, the Thomson-Houston System has no equal. The Lights are *superior in color and steadiness*, and the entire apparatus is more *economical, efficient* and *safe*, more *easily managed*, and *less liable to derangement* than any other.

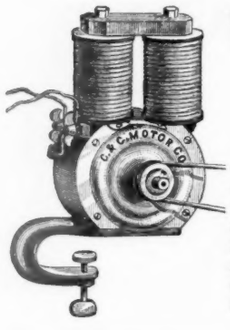
The Thomson-Houston Electric Company

was awarded the FIRST PRIZE for the *best system* of Arc-Lighting, and the *best Arc Lamp*, at the Cincinnati Industrial Exposition of 1883.

The Thomson-Houston System

has been awarded *superiority in all the competitive tests* to which it has been subjected.

New Illustrated Pamphlet will be sent on application.



The C. & C. Electric Motor Co.

2 WALL STREET, NEW YORK CITY.

This Company is now prepared to furnish Motors of ⅛ horse power and upwards, of Unrivaled Efficiency, convenient in form, neat in appearance, cheap and durable, for Sewing Machines, Jewelers' Lathes, Dental Engines and other small power. Our Battery the most efficient; furnishes ample power for motor or six candle lamp or cautery, etc. Also Special Motors for use on Lighting Circuits for larger power, and *vice versa*, with Steam Power for Electric Lighting in small quantity.

THE

India-Rubber & Gutta-Percha Insulating Co.

MANUFACTURERS OF

ALL KINDS OF INSULATED WIRES AND CABLES.

Guaranteed to give satisfactory services under ground and over head. Specially adapted for Chemical Works, Paper Mills, Dye Works, Coal Mines, etc., etc.

PRICES AND SAMPLES ON APPLICATION AT

No. 159 Front Street, New York City.

A CARD TO THE PUBLIC.

The Edison Electric Light Company having instituted suits on its patents, must decline to substitute the advertising columns of the press for the courts for the purpose of their legal interpretation. Mr. Edison's Carbon filament patent of 1879 covers broadly the modern incandescent lamp. The claim that this patent has ever been in litigation in the United States Patent Office is absolutely false. In Germany and England this fundamental patent has finally prevailed against all infringers, thus establishing the fact that Mr. Edison's great invention has been nowhere anticipated. Ergo, a like result must follow in the United States. The straining and distorting of these facts, together with the violent effort to interweave with them certain minor and IRRELEVANT CASES for the purpose of fraudulently posing before the public as joint heirs with Mr. Edison in the fruits of these patent decisions, only indicate the DIRE EXTREMITY of those who are thus gradually becoming ENVIRONED by due process of law.

THE

Edison Electric Light Co.

16 and 18 BROAD ST., NEW YORK.

GUTTA PERCHA
ARMOR WIRE
GUTTA PERCHA IS THE STANDARD INSULATION.
Does not deteriorate, and for underwater or underground is the most Reliable and Durable.
Aerial or Underground. Any number of Conducting Wires.
Marks' Compound and Balata Insulated Wires, Cordage and Cables, for Office, Aerial, Underground and Battery Uses.
ESTABLISHED IN 1847.
BISHOP GUTTA-PERCHA CO.
ORIGINAL AND ONLY MANUFACTURERS IN AMERICA OF
Gutta Percha Insulated Telegraph, Telephone & Electric Light
WIRES AND CABLES
FOR SUBMARINE, UNDERGROUND & AERIAL USE.
SAM'L BOARDMAN, Pres't.
HENRY A. REED, Sec'y.
W. W. MARKS, Sup't.
420 TO 426 EAST 25TH STREET,
NEW YORK.
TELEPHONE CALL: 191-21ST ST.
Balata Cord, for Incandescent Light.
RIVER CABLES. Gutta Percha Insulation. Any number of Conductors.
Burglar Alarm, Annunciator, Electric Light and Gas Lighting Wires and Cables. Silk, Cotton and Fibre Covered Magnet Wires, Flexible Cables and Cordage. G.P. Sheet or Chatterton's Compound for Cable Splices, and Pure G.P. Goods of every variety
Acid Vessels, Pipes, Vats, Etc.
Marks' Compound Wire, for Battery Coppers.

PHOSPHOR BRONZE
TELEPHONE WIRE.

"Phosphor-Bronze."

SPRING SHEET and SPRING WIRE for ELECTRICAL APPARATUS.

THE PHOSPHOR BRONZE SMELTING CO., LIMITED.
512 ARCH ST., PHILADELPHIA, PA.

Owners of the United States Phosphor Bronze Patents. Sole Manufacturers of Phosphor Bronze in the United States.

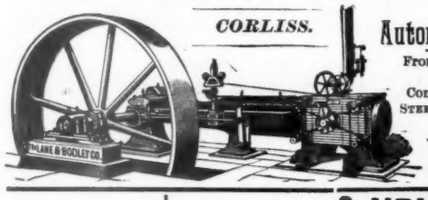
LEATHEROID.

The best Substitute for Hard Rubber for all Electric, Insulating and Mechanical Purposes, costing less than any other insulating material of its class. Furnished in Sheets and Tubes of various thicknesses.

EXPERIMENTAL WORK CAREFULLY AND PROMPTLY DONE.

THE LEATHEROID NOVELTY COMPANY, 74 Bedford Street, Boston, Mass.
Send for Samples and Prices.

The Lane & Bodley Co.



MANUFACTURERS OF
Automatic Cut Off Engines,
From heavy patterns, and unequaled for ELECTRIC LIGHTING, Combining Economy and Reliability.
STEEL BOILERS, HEATERS, SHAFTING, PULLEYS AND GEARING.
THE LANE & BODLEY CO,
265 to 273 Water St.,
Cincinnati, O.

NEW ENGLAND BUTT CO.,

Providence, R. I.,

MANUFACTURERS OF

BRAIDING MACHINERY

FOR COVERING

Telegraph, Telephone

AND

ELECTRIC-LIGHT WIRE.

ALSO

SINGLE AND DOUBLE

WINDERS AND BRAIDERS

Of every Description for Silk, Worsted and Cotton Braid.

FINE CASTINGS A SPECIALTY.

SOUTHERN ELECTRIC COMPANY.

ELECTRIC LIGHT SUPPLIES.

Insulators, Cross-arms, Locust and Oak Pins, Chestnut and Cedar Wire Poles, Turned Lamp Posts, Galvanized Iron Pole Steps, Ornamental Wrought Iron Brackets, Insulated Coppe Line Wire, &c.

REPAIRS TO MACHINES AND LAMPS OF ANY SYSTEM MADE PROMPTLY. DUPLICATE PARTS OF APPARATUS FURNISHED ON RECEIPT OF SAMPLE.

We manufacture and keep in stock PHOSPHOR-BRONZE BRUSHES, which are in every way superior to the copper brush. They spark less, last longer and do not cut the Commutator. Commutator Rings last twice as long when our Brushes are used

Fittings for Incandescence Lamps made to order, including Sockets, Holders, Switches, Cut-outs, Shade holders and all other Appliances necessary to the business.

WAREROOMS,

Hoen Building, North & Lexington Sts.

WORKS,

CONSTITUTION & MONUMENT STS.,
BALTIMORE, MD.

BOOKS

ON ELECTRICAL SUBJECTS will be mailed to any address, postage prepaid, on receipt of price. Address, ELECTRICAL REVIEW PUB. COMPANY, 23 Park Row, New York. P. O. Box, 3,329.

Arc Light, and Gas Companies
ATTENTION!

Owing to Recent Improvements we now make a Specialty of

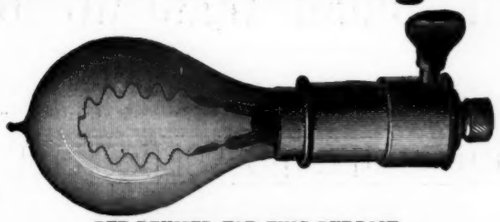
CENTRAL STATION WORK

AND OFFER THE

MOST COMPLETE AND ECONOMICAL

SYSTEM OF

Incandescent Lighting



YET DEVISED FOR THIS PURPOSE.

The COST of Installation is GREATLY Reduced and LONG DISTANCE Lighting Successfully Accomplished, from a COMMERCIAL STANDPOINT.

FOR FULL INFORMATION ADDRESS

The United States Electric Lighting Co.

59 and 61 LIBERTY ST., NEW YORK.
216 LA SALLE ST., CHICAGO, ILL.

CHAS. A. CHEEVER, President.

OKONITE

TRADE MARK.

WILLARD L. CANDEE, Treasurer.

THE OKONITE CO.

13 PARK ROW.

INSULATED WIRES AND CABLES.

CHICAGO BRANCH. *1022 Opera House Building,* CHICAGO.

MINNESOTA BRANCH. *Minneapolis Electric Co.,* MINNEAPOLIS.

PHILADELPHIA BRANCH. *Novelty Electric Co.,* 5th and Locust Sts., Philadelphia.

8-Conductor Aerial Telephone Cable.

DAY'S Kerite Insulated

WIRES AND CABLES

For Telephone, Telegraph and Electric Light Use and Electrical Circuits Generally.

The reliability and durability of Kerite Insulation is unsurpassed, as has been proven by years of experience. All rubber and gutta-percha compounds are very short-lived when placed either in the air or under ground, and the supposed new insulating materials now being presented to the public, are most of them old and discarded experimental products. The present high standard and uniform quality of Kerite is the result of 30 years' experience.

The attention of TELEPHONE MANAGERS is especially asked to our ANTI-INDUCTION TELEPHONE CABLES, they being the most practical and durable in the market.

TELEGRAPH, TELEPHONE and ELECTRIC-LIGHT WIRES for either SUBMARINE or UNDERGROUND WORK a specialty. Estimates for complete systems of underground wires and conduits will be furnished on application.

AUSTIN G. DAY, Sole Manufacturer,

CLARK B. HOTCHKISS, Gen'l Agent,

16 DEY STREET, NEW YORK.

The Brush-Swan Electric Light Co.

OF NEW ENGLAND.

W. L. STRONG, President. GAYLORD McFALL, Secretary.
A. D. JUILLIARD, Vice-President. R. W. ABORN, Treasurer.
JOHN B. POWELL, General Manager.

OFFICE, No. 36 UNION SQUARE, (EAST).

NO OTHER SYSTEM IS AS ECONOMICAL IN INSTALLATION AND MAINTENANCE

NO OTHER ELECTRIC LIGHT APPARATUS IS AS DURABLE.
THE FIRST MACHINES MADE ARE STILL IN DAILY OPERATION.

THE SYSTEM COMPRISES:
- Arc Lights of various Sizes.
- Arc and Incandescent Lights from one Dynamo and Circuit.
- Incandescent Lights of various Sizes from Special Dynamo for Central Station Lighting.

Cost of Apparatus Greatly Reduced. Surveys and Estimates Furnished by Experts

G. W. STOCKLY, President. J. J. TRACY, Vice-Prest. W. F. SWIFT, Secretary.
J. POTTER, Treasurer. N. S. POSSONS, Supt. W. J. POSSONS, Asst. Supt.

THE BRUSH ELECTRIC CO.

The Sole Manufacturers, under all the patents of Charles F. Brush, for Electric Lighting, Storage Batteries, Carbons, Electro-Plating Machines, Electric Motors, etc.

WE FURNISH THE ONLY COMPLETE and PERFECT SYSTEM OF ELECTRIC LIGHTING.

Machines for Arc Lighting, giving lights of 1,200, 2,000, 3,000, 4,000, and up to 100,00 candle power. Our No. 8 machine gives 65 lights of 2,000 c. p. with about 45 H. P.

Over twenty different styles of arc lamps, for indoor and outdoor use, and for tower lighting.

MACHINES FOR INCANDESCENCE LIGHTING,

adapted for use with Swan Incandescence lamps. These machines are automatic and do not require the use of any switches or resistances outside of the machine to govern the current. Will run any number of lamps from one up to the full capacity of the machine, without change of speed and without the use of any apparatus outside of the machine.

Our prices are lower than other makers.

Storage Batteries, for Incandescence Lighting and for **Electric Motors.** Our storage batteries are the only practical ones offered in the market.

CARBONS FOR ARC LAMPS.

Our carbons are the purest and best made. We have the largest and most fully equipped carbon factory in the world, and our prices are very low.

ELECTRIC MOTORS.

We have commenced the manufacture of the Brush Electric Motors and shall soon be prepared to fill orders for all sizes from one up to forty horse-power. In many locations these are the most economical producers of power and will be largely used by Lighting Companies and others where small powers are required.

THE BRUSH ELECTRIC CO., *Cleveland, O., U.S.A.*

ANSONIA BRASS & COPPER CO.,

Manufacturers of

Pure Electric Copper Wire,

BARE AND COVERED, OF EVERY DESCRIPTION.

"ACME" BRONZE TELEGRAPH AND TELEPHONE WIRE.

Warerooms: 19 & 21 Cliff St., New York. Factories: Ansonia, Conn.

Incandescent Lighting on Arc-Light Circuits.

The Brown Automatic Converter

Will supply and take care of ten to twelve 16 C. P. Incandescent Lamps, at any point on an arc-light circuit from an initial current equal to 2,000 C. P. arc lamp.

Can be used with any make of arc-light dynamo.

Any number of the lamps can be turned on or off without affecting the rest.

Invaluable to arc lighting companies as a means by which they can secure customers, from one up, for incandescent lighting anywhere on their circuit, without involving the large expense for incandescent lighting plants, or the necessity of getting a large number of subscribers to commence with. Address,

THE BROWN ELECTRIC CO.,
400 WOOD ST., PITTSBURGH. PA.

FOREST CITY CARBON MFG. CO.

MANUFACTURERS OF

AUSTRIAN-AMERICAN CORED CARBONS.

—ALSO—

Solid Carbons for Electric Arc Lighting.

HOLMES, BOOTH & HAYDENS,

SOLE AGENTS,

No. 25 PARK PLACE, NEW YORK.

BRIDGEPORT BRASS CO.,

BRIDGEPORT, CONN.,

INCORPORATED 1865.

BRASS, COPPER AND GERMAN SILVER

WIRE AND ROLLING MILLS,

Bare and Insulated Copper Wire for Electric Conductors a specialty.

SOLE AGENTS FOR THE

BRIDGEPORT ELECTRIC MFG. CO.

ARMINGTON & SIMS ENGINE COMPANY — TRADE MARK — PROVIDENCE, R.I. U.S.A.

THE ARMINGTON & SIMS

Automatic Cut-Off Engine,

FOR ALL PURPOSES WHERE POWER IS REQUIRED.

CLOSE REGULATION,
ECONOMICAL OF FUEL,
SMALL SPACE REQUIRED,
MODERATE PRICE.

OVER 2,000 ENGINES IN USE.

SELLING AGENTS.

JARVIS ENGINEERING CO., 61 Oliver St., Boston.
POND ENGINEERING CO., St. Louis, Mo.
J. F. RANDALL, Warren, Ohio.
JOHN R. MARKLE, Detroit, Mich.
H. B. SMITH MACHINE CO., 925 Market St., Phil., Pa.
F. H. HAYWARD, 81 Lake St., Chicago, Ill.
T. W. ANDERSON, New Orleans, La.
E. P. HAMPSON & CO., 36 Cortlandt St., New York.
TANNER & DELANEY ENGINE CO., Richmond, Va.
MORTON REED & CO., Baltimore, Md.
A. J. MILLER, Danville, Va.
W. R. BURGESS, Greensboro, N. C.
W. S. JOHNS, Pensacola, Fla.
S. S. PEGRAM, Macon, Ga.
J. A. HAUSER, Montgomery, Ala.

William Marshall,

Manufacturer of ELECTRICAL CONDENSERS.
STANDARDS A SPECIALTY.
Rooms 2 and 4 University Building.
Corner Waverley and University Places, New York.

ELECTRIC LEATHER BELTING

MOST RELIABLE FOR DYNAMOS AND SWIFT-RUNNING MACHINERY.

Warranted to run steady and smooth, and without stretching. Write for particulars and prices to

CHARLES. A. SCHIEREN & CO.
Manufacturers and Tanners of Oak Leather Belting and Lace Leather.

47 Ferry Street, New York.
15 ARCH ST., PHILADELPHIA. 86 FEDERAL ST., BOSTON

THE

Parker-Russell Mining & Mfg. Co.

SUNLIGHT CARBONS

711 PINE STREET,
ST. LOUIS, MO.